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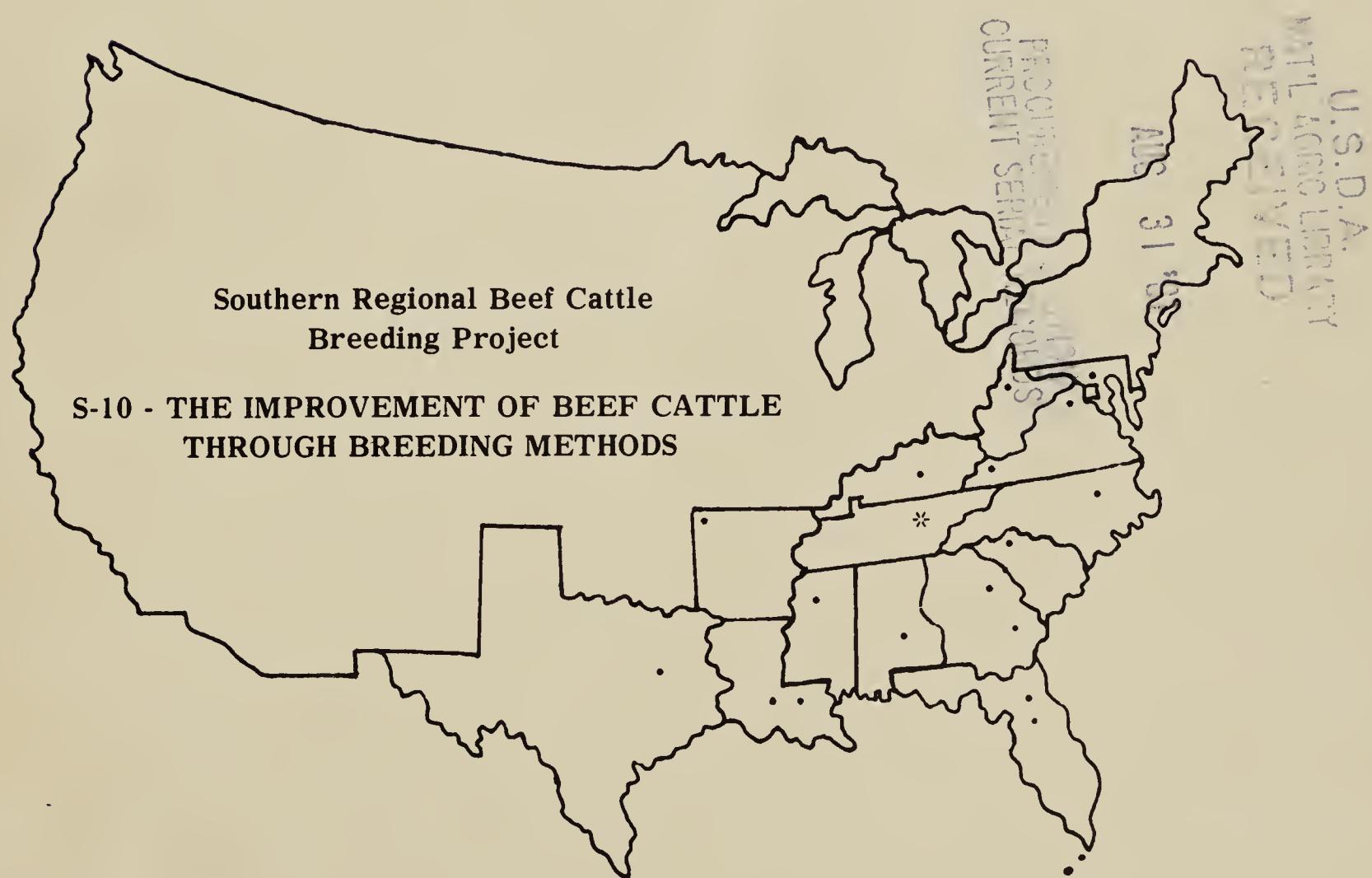
COOPERATING SOUTHERN STATES

1964-1965 Annual Report of S-10

and

Report of Annual Technical Committee Meeting  
Lexington, Kentucky

June 6-9, 1965



This report is intended for the use of administrative leaders and workers  
and is not for general publication.



S-10 - 1964 ANNUAL REPORT

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PERSONNEL OF THE S-10 PROJECT

I. Technical Committee:

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Arkansas	C. J. Brown
Florida	Marvin Koger
Georgia	W. C. McCormick
Kentucky	N. W. Bradley
Louisiana	N. C. England
Mississippi	C. E. Lindley
North Carolina	E. U. Dillard
South Carolina	W. C. Godley
Tennessee	C. S. Hobbs
Texas	T. C. Cartwright
Virginia	J. A. Gaines
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Station, Jeanerette, Louisiana  
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Front Royal, Virginia  
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III. Regional Officers, 1964-1965:

Doyle Chambers, Administrative Advisor, Baton Rouge, Louisiana  
E. U. Dillard, Chairman, Raleigh, North Carolina  
C. J. Brown, Secretary, Fayetteville, Arkansas  
N. C. England, Executive Committee member, Baton Rouge, Louisiana

## INTRODUCTION

This project was initiated in 1948 to investigate and develop methods of breeding more productive beef cattle for the South. Detailed annual reports showing research developments and progress in each state have been prepared each year since 1950. Complete results of certain phases of the project have been reported in a regional bulletin on crossbreeding and several technical articles and bulletins published by workers in the various states which contribute to the S-10 project.

This publication includes the proceedings of the 1965 annual meeting of the S-10 Technical Committee and the annual reports of projects in each of the 12 contributing states. The annual reports of S-10 contributing and supporting projects were prepared by the project leaders and other personnel at the various stations as summaries of the research developments and progress at each station during 1964. The results are not considered final, but the materials aid cooperators and the Regional Coordinator in developing an integrated program. This report also provides information needed by heads of animal husbandry departments, experiment station directors, and U. S. Department of Agriculture officials for evaluation of the projects with respect to objectives and procedures. This report is not for general distribution, and material contained in it should not be quoted in publications.

### Scope of the Project and Recent Developments

Active beef cattle breeding research under the direction and coordination of the S-10 Regional Project - Improvement of Beef Cattle for the Southern Region through Breeding Methods - was carried on in 12 states and at three state-federal cooperative experiment stations - located at Brooksville, Florida; Jeanerette, Louisiana; and Front Royal, Virginia - in 1964. This research was conducted under cooperative agreement between the U. S. Department of Agriculture and the state concerned and/or as contributions to the S-10 regional project.

The S-10 project is, in general, a study of crossbreeding and hybrid vigor, inbreeding and line crossing, selection for economic traits, genetic-environmental interactions, genetic defects, and ways of identifying traits of economic value in the carcass as well as in the live animal. Much of the S-10 region is subtropical, and research evidence indicates that cattle commonly used in other areas may be poorly adapted to the prevailing conditions here. In some parts of the region environmental conditions appear to adversely affect survival, reproductive regularity, and growth.

Approximately 11,364 beef cattle were inventoried as of July 1, 1965, in research herds at the contributing stations. This continues the trend toward a decrease in numbers shown over the last few years as projects are revised and cattle used simultaneously in more than one project for increased efficiency of utilization. The total inventory includes 5619 cows two years and older, 1341 yearling heifers under one year, 1857 bulls and steers under one year,

1810 heifers under one year, 533 bulls over one year, and 204 steers over one year of age. Approximately 849 bulls - some of which belonged to cooperators - were performance-tested during the past year, as were 1004 heifers and 959 steers. Carcass information was collected on 154 bulls, 251 heifers, and 884 steers.

Much of the research has been in force for a considerable length of time and is now yielding worthwhile information. In crossbreeding, for example, 12 years of research have been completed at Louisiana State University comparing single crosses to straightbreds and five years of detailed comparisons of straightbreds, single crosses, back-crosses, and three-breed crosses have been made. Over ten years of crossbreeding work has been carried on at the Virginia, Georgia, Florida, Alabama, and Texas stations. The inbreeding and selection work at the Front Royal station is in its 14th year, and projects investigating other aspects of beef cattle breeding were initiated at Alabama, Arkansas, Florida, Georgia, Tennessee, Texas, Virginia, and Jeanerette within a few years after the approval of the S-10 regional project in 1948. Other contributing research in some of the above-mentioned states - as well as in Kentucky, Mississippi, North Carolina, and South Carolina - has been initiated more recently, but is already yielding significant results.

Revision of experiments at the Alabama and South Carolina stations is presently contemplated. It is anticipated that the revised Alabama study will be concerned with genetic-environmental interactions and recurrent selection for carcass characteristics will be studied at South Carolina.

A regional publication is being prepared on reproduction of beef cattle in the South, incorporating fertility and calf crop information studied at the various states, as well as data specifically collected for a regional fertility study. Several states also cooperated in a study involving the influence of mature cow size on calf production.

#### Research Results During the Year

The research results in the S-10 project are cumulative and are of a continuing nature, since the beef cattle breeding projects cover a period of several years. The chief accomplishments and results of a more or less specific nature are as follows.

Considerable evidence continues to indicate that preweaning growth rate and type score are approximately 30 percent heritable. In a summary of data collected over an eight-year period at the Virginia station, estimates of heritability and genetic correlations were made for average daily gain from birth to weaning and weaning grade. For Angus calves, combined heritability estimates of average daily gain and grade were  $0.38 \pm .03$  and  $0.36 \pm .04$ , respectively. Corresponding heritabilities for Hereford calves were  $0.31 \pm .04$  and  $0.33 \pm .04$ . Phenotypic and genetic correlations between preweaning average daily gain and weaning grade were  $0.23 \pm .01$  and  $0.23 \pm .06$  for Angus and  $0.28 \pm .01$  and  $0.21 \pm .08$  for Hereford calves. All these data were pooled over sexes. These estimates of heritability for average daily gain up to

weaning and weaning type score are in line - for the most part - with previous estimates. However, although the genetic correlation between average daily gain and type score was somewhat lower than some previous estimates, there is an indication that selection for preweaning growth rate will result in improved type score.

Published results from the Arkansas station tend to give slightly lower heritability estimates for indications of preweaning growth rate than the afore-mentioned Virginia work, although the Arkansas estimates are similar to previous estimates. These estimates - based on regression of offspring on sire of 210 male progeny in 20 sire groups - were  $0.19 \pm .09$  for 120-day weight,  $0.27 \pm .13$  for initial test weight,  $0.93 \pm .18$  for test daily gain,  $0.43 \pm .18$  for feed consumption,  $0.14 \pm .25$  for feed conversion,  $0.15 \pm .15$  for type score,  $0.37 \pm .14$  for final test weight, and  $0.79 \pm .18$  for production index.

Additional information on the relationship of preweaning gain with postweaning growth rate continues to indicate the fairly high correlation of growth in different periods. One recently-completed study reports correlation coefficients of preweaning average daily gain with weaning weight, 18-month weight, and 24-month weight of 0.82, 0.59, and 0.57, respectively, for Brangus and 0.82, 0.37, and 0.31, respectively, for Africander-Angus replacement heifers. The relationship of weaning weight to 18-month weight was 0.76, and the relationship to 24-month weight was 0.62 for Brangus and 0.88 and 0.78, respectively, for Africander-Angus. Preweaning average daily gain of steers - limited fed during the winter and then placed on postweaning feeding test - was significantly related to postweaning gain on test, lifetime gain, and final weight in both Brangus and Africander-Angus.

In work relating to feed consumption and other economic traits, the Arkansas station reports that about 59 percent of the variance in gain is associated with feed consumption and initial weight. In this same study, bulls with heavier testicles were poorer converters of feed when put on a constant weight basis ( $r = 0.44$ ); whereas, the bulls with more lean tissue - as indicated by cut weights and muscle area - were better converters of feed. This would suggest that as the bull matures sexually and the endocrine function of the testicle increases, it elicits two effects on feed conversion that are antagonistic. In the same study, agonistic behavior and social rank within the pen were correlated with eight production traits and eight body measurements of performance-tested bulls. No breed differences in agonistic behavior were noted. Chest depth and heart girth were significantly correlated with agonistic behavior within a group. These pooled intra-group correlations were low for chest depth and heart girth.

The relationship of cow size to productivity has interested animal breeders for some time. Several S-10 studies indicate that cow size is heritable and may be related to production. Analysis of data from the North Carolina station indicated that cows which were heavier 90 days before calving tended to produce heavier calves at birth and throughout the suckling period. These data suggest that this association is larger for younger cows and that the pattern of change in dam's weight appeared to be subject to herd and age effects.

The effect of weight of dam on 180-day weight of Hereford calves raised at the Texas station and on weaning weights of Angus calves raised in a privately-owned herd was studied. Hereford cows were weighed at calving and the Angus cows weighed at weaning. A linear relationship between calf weight and cow weight was observed in the Angus while a curvilinear relationship was observed in the Herefords. Average calf weight increased by 8.5 and 4.9 pounds per hundred pounds increase in weight of dam for Angus and Herefords, respectively, when weight of dam was included as a continuous variable. Simple correlations between 180-day calf weight and weights and measurements of their dams were: cow weight, 0.34; heart girth, 0.33; hook width, 0.36; and wither height, back length, and rump length, 0.45. Multiple correlations of calf weight with measurements of cow size were 0.50 with wither height and back length, and 0.52 with all measurements including weight.

Heritability estimates determined by an Arkansas study of the genetic influence on cow size and related traits were weight, 0.44; wither height, 0.41; hip height, 0.69; shoulder width, 0.40; hip width, 0.11; chest depth, 0.71; rear flank depth, 0.39; heart girth, 0.46; and body length, 0.48. These data indicate that progress could be made in selection for cow size and/or the components of cow size. In this same study, dry cows were about 100 pounds heavier than wet cows, with greater dimensions in those measurements influenced by fatness. No consistent increase in weight or dimensions was associated with age over the range studied.

Records from herds in Alabama, Florida, Georgia, Louisiana, North Carolina, South Carolina, and Texas were included in a cooperative regional cow weight study. Preliminary analyses include weight of cow when she calved, when her calf was weaned, or both. Data were analyzed on both an individual-location and pooled-location basis. All sources of variation, including location-year, breed within location-year, sire within sire, progeny within sire, age of dam, and previous parity plus calving month for weight at calving, were statistically significant at the 0.05 level. These data indicated that cow weight increased with each year's increase in age up to nine years of age - the limit of these data - but the rate of increase was less with age. Cows not parous the previous year weighed 56 pounds more than parous cows at calving and 21 pounds more at weaning. Fall-calving cows were heavier than spring-calving cows. The heritability estimate of cow weight at calving was 0.96 and at weaning it was 0.74.

Further evidence shows that certain carcass traits are at least partially inherited. Continued analysis by the Tennessee station of data from British, Zebu, and dairy steers used for beef indicated significant differences in almost all carcass composition characteristics. Among the seven breeds used - Angus, Brahman, Brahman-cross, Hereford, Holstein, Jersey, and Santa Gertrudis - the short-shanked, blocky, thickly-fleshed Angus carcasses had the lowest percent separable muscle, separable bone, moisture, protein, round + loin + rib + chuck, and foreshank; with the highest percent separable fat, ether extract, and brisket. The long-shanked, long-bodied Holstein carcasses produced the highest percent separable muscle, separable bone, moisture, protein, round, and foreshank; the highest percent separable muscle and bone within all except two wholesale cuts; and were lowest of all breeds in percent separable fat of the entier side, ether extract, flank, and separable fat in all but one wholesale cut. These results

and those from the other five breeds depict the role that fat plays in depressing percent separable muscle, separable bone, protein, and yield of major untrimmed wholesale cuts among breeds. Length may confound this relationship among breeds, since the breeds with longer carcasses also possessed lesser amounts of external finish. Results of work at the same station and on the same group of cattle, but from a different analysis, indicated that of the two British breeds, Herefords had significantly higher percents of shank, tail, hide, and spleen, but lower percents of pluck, liver, omasum, and ruffle fat than Angus. No differences between breeds in percent of empty components of the gastro-intestinal tract were significant. Within the three groups containing at least 37 percent Brahman breeding - i.e., Brahman, Brahman-cross, and Santa Gertrudis - straight Brahman steers tended to have lower percents of pluck, heart, caul fat, and empty omasum. The Brahman-British crosses and Santa Gertrudis differed significantly only in percent empty large intestine. Of the two dairy breeds, the Holsteins had significantly higher percents of blood, shank, and small intestine (full), than Jerseys. However, the Jerseys had significantly higher percentage of most full and empty components of the gastro-intestinal tract than did other breeds and had a significantly lower dressing percent, while both dairy breeds dressed significantly lower than the other five breeds.

Studies of carcass characteristics in relation to the genetic aspects of beef cattle improvement continue, and some stations are enlarging their efforts. In an attempt to determine what constitutes good "eating quality" in beef, the Tennessee station has studied data from 15 bull, steer, and heifer trios to determine the effect of sex on performance and carcass traits. Bulls gained faster and more efficiently than steers of heifers, and steers gained faster and more efficiently than heifers. However, bull carcasses graded lower than steers or heifers and bull meat was less tender, darker, and coarser-textured than meat of the other sexes. At the same station, studies on the effects of level of finish and method of finishing on carcass traits are in progress.

Effort continues to determine traits in the live animal that can be identified with greater carcass value. The use of ultrasonics in live animal carcass evaluation is still being studied by the Animal Husbandry Research Division in cooperation with the Tennessee station. Correlations between predicted and carcass backfat thickness indicate that this tool can effectively be used to measure fat thickness. Previous work at the Tennessee station showed that a measure of fat thickness and carcass weight accounted for a large portion of the variation in leaness of the carcass. Work is planned to determine whether fat thickness of the live animal - as estimated by ultrasonics - and live animal weight can effectively determine lean proportion of the carcass.

One station has studied the relative association of feed consumption, initial weight, and indicators of carcass leanness with feedlot gains. A comparison of multiple correlations indicates that about 16 percent of the variance in gain was associated with round and loin weight, ribeye area, and fat thickness. On a constant weight basis, forequarter and chuck were significantly related to gain ( $r = 0.33$ ). These data support previous evidence that some carcass traits - especially those measuring muscling - are associated with growth rate.

Additional information on age of puberty in straightbred and crossbred heifers at the Louisiana station indicates that breed crossing results in an appreciable amount of heterosis for this trait. A number of crossbred heifers have calved at two years of age and have done so with little difficulty. Previously, this station had reported little evidence of heterosis for puberty, in contrast to British breed crossing results at the Nebraska station where a positive heterotic effect had been reported. It appears that in the early years of the Louisiana puberty study, environmental conditions - mainly pasture - had been such that the effects of heterosis for this trait were masked. This supports the idea of continued breeding and selection work over a period of years, as well as replication of experiments at different locations with wide environmental differences.

Continuation of research at several stations on differences between breeds in reproductive rates, as well as an S-10 regional fertility study, gives evidence that even though calculated heritabilities for various measures of fertility are low, breed differences still exist. Data from a Louisiana study showed large differences in calving percent between breeds and crosses, although these were not significant due to large within-group variation. Selective mating of Brahman sires was indicated by differences in calving percentage when Brahman bulls were used on British cows, as compared to British x British, Brahman x Brahman, and British bull x Brahman female matings. In contrast, the Florida station has found heritability estimates of calving percentage to be considerably higher than previously reported. These estimates, which were made from data from cooperators herds, were in the neighborhood of 0.3 to 0.6. Some researchers support the philosophy that when heritability of calving percentage is estimated on data from selected cows, the proportion of genetic variation is limited. In reviewing the Florida study, as well as the selection of cows in S-10 breeding herds, there is little evidence that heifers are selected on the basis of the reproductive performance of either their dams, sires, or grandsires.

Work on genetic-environmental interactions is being continued in two studies in the Southeastern United States - one a cooperative effort between the Brooksville, Florida, station and the Miles City, Montana, station, and the other at the North Carolina station. Since both of these studies are still relatively new, few results have yet been analyzed. Another year's data at the North Carolina station indicate that sire-location interactions or evidence of genotype-environmental interactions are small. The cooperative study between the Florida and Montana stations is only in its fourth year and, as yet, gives no concrete evidence of genetic-environmental interaction. There was a large contrast this year between the calving percentages of the Miles City cattle transported to Florida, as compared to cattle of the Miles City line raised at Florida and the Hereford cattle that have been at Brooksville for several generations.

Bulls performance tested under two widely different levels of nutrition will be progeny tested to try to determine if performance of progeny can be predicted better under one system than the other. The progeny of bulls from each nutritional level will be fed out under both levels of nutrition.

Limited research on snorter dwarfism is being continued at the Florida experiment station. Embryology studies of the dwarf and normal genotypes are being made in order to bracket the age that the abnormality first appears. Electrophoretic studies of various body fluids are continuing. Cytological studies to date have shown no differences in genotypes.

A major portion of the Southern Regional Beef Cattle Breeding Project has been, and continues to be, devoted to the study of crossbreeding of beef cattle. Data taken from the first eight years of the Louisiana study indicate that crossbred calves were heavier at all ages than purebred calves. However, these differences were not significant until the calves reached 112 days of age. Crossbred calves grew somewhat more rapidly than purebred calves throughout the entire preweaning period. The preweaning growth curve was different for calves from British breed cows, as compared with calves from Brahman and Brangus cows. Calves from all four breeds of dam - Angus, Brahman, Brangus, and Hereford - grew at about the same rate for the first 140 days. At that time, growth rate of calves from British breed cows decreased while the growth rate of calves from Brahman and Brangus cows remained relatively constant. This may be due to greater persistency of lactation in Brahman-type cows. These data support the previous evidence that the effect of age of calf on weaning weight varies considerably from one breed to another.

During the past year, a study was made to determine if reciprocal-cross females are equally good for use as brood cows. Previous work indicates that reciprocal crosses do not, themselves, wean at the same weights if the two breeds used for crossing differ in mothering ability. It has generally been assumed, however, that reciprocal crosses would be equally productive when used as dams, since they would be of essentially the same genetic constitution. From the data studied, it was apparent that reciprocal-cross cows resulting from wide crosses are not equally productive insofar as the weaning weight of their calves is concerned. When the breeds involved in the original cross are very similar, the reciprocal crosses, themselves, are quite similar in productivity. It is quite possible that the differences between reciprocal-cross cows are due to a permanent effect of their own early maternal environment.

Also at the Louisiana station, a summary of calving dates and calving percentages by various sire-dam breed combinations indicates that Brahman bulls show some degree of selectivity as to the kind of cows with which they mate. Observation of the breeding behavior of Brahman bulls over the past 12 years has brought out the fact that some Brahman bulls definitely show strong preference for Brahman-type cows.

Several stations have been comparing different systems of mating for several years. The Georgia station has completed one generation of a comparison of grading-up, criss-crossing, and three-breed rotational crossing. The cows of the criss-crossing and three-breed rotational systems have had a weaning percentage advantage of approximately 3 percent over the grades. There has been little difference in the three systems in percentage of calf crop born, indicating that the crossbred calves have a higher survival rate than do the straightbred calves.

Another study comparing two-breed crosses with three-breed crosses indicates an advantage at weaning time of approximately 23 pounds in favor of the three-way cross steers. However, no differences were noted in postweaning performance. Smaller differences were obtained in heifers than in steers. A separate study showed a significant difference between breed crosses for weaning weight in favor of the crossbred calves. The crossbred cows in this study weaned a higher percentage of calf crop and remained in production longer than did straightbred Hereford controls.

A study of the combining ability of Angus sires at the Florida station indicates a definite sire x breed interaction. One Angus bull sired better crossbred calves than he did Angus calves, and another bull sired better Angus calves than he did crossbred calves. In order to determine whether this ability is passed on to their offspring, sons of the two "interaction bulls" are being presently used in a progeny test.

Differences between breeds in viability of calves was noted at the Jeanerette station where an average mortality during the first 72 hours after birth was 5 percent. Calf death losses were as high as 22 percent during the first month following birth for the Brahman breed; whereas, calves resulting from Brangus cows, i.e. crossbred foundation, or three-breed cross calves resulting from Brangus bulls on  $F_1$  cows had a much higher survival rate.

Comparison of inbred lines within breeds and between breeds - as well as to lines selected for type and growth - continues at the Front Royal station. This project has proceeded far enough that bulls from the inbred lines, as well as the selection lines, will be top-crossed on unrelated cattle at Blacksburg, Virginia, for the Shorthorn lines and at Mississippi State University for the Angus lines in order to test the lines.

Several long-time experiments on the progress of selection for specific traits over a period of generations are being continued. In a preliminary report from one station, generation-one cows from four selection lines - i.e., (1) weaning weight, (2) rate of postweaning gain, (3) weaning score, and (4) average performance - were compared to foundation cows set up in each of these lines. Calves from the foundation cows in each of these lines have proven to be superior in growth rate to calves from the generation-one cows in the 1964 calf crop data. It is interesting to note that the average daily gain from birth to weaning for the 1964 calf crop from the foundation cows was about the same in all selection lines as average daily gain from birth to weaning in the generation-one cows.

In an experiment at the Kentucky station to select for rate of gain, efficiency of gain, conformation, and carcass characteristics, the foundation herds have all been established with progeny-tested sires. Progeny tests of future prospective sires are being continued.

### Future Plans

Work will continue at the three federally-owned, jointly-operated stations as outlined in the line projects and the S-10 Southern Regional Beef Cattle Breeding Project along the lines of selection, breeding systems, beef quality and carcass work, studies of genetic abnormalities, and projects of related interest. Projects at the Alabama and South Carolina stations are being studied for revision.

Special committees set up by the S-10 Technical Committee have been in operation during the past year and have made recommendations for operation during the future year. The committee on carcass and beef standardization submitted a report for standardization procedures of handling live animals before slaughter, carcass observations, standardized palatability procedures, and determination of tenderness.

The data collection and analysis committee has suggested a project on the study of heritability of fertility in the Southeastern United States. The S-10 Investigations Leader will prepare a proposed project outline for suggestions and comments of the committee, and after approval by the Executive Committee, data will be collected and analyzed.

### Public Interest in the Program

Results from the S-10 regional project and the AHRD line projects are continually being used to supply information to breeders at breed conferences, field days, short courses, and in popular articles. Commercial beef cattle operations request information on the use and results of crossbreeding and ways to maintain crossbreeding systems in a beef cattle breeding operation over a long period of time. Each year a larger segment of the purebred industry uses performance test information in their selection programs. Eight states in the Southeastern United States have central bull testing facilities where bulls from cooperators are tested. Approximately 2500 herds of beef cattle are on production testing programs in the S-10 region.

TABLE 1. Cattle Inventory and Percent Used in S-10 Contributing Projects  
July 1, 1965

State	Cows two years and over	Year- ling heifers	Bulls and steers under one yr.	Heifers under one yr.	Bulls over one yr.	Steers over one yr.	Total Number	Percent used in project
Alabama	408	55	153	146	28	9	799	100
Arkansas	300	78	120	104	83	-	685	100
Florida	29	3	-	6	4	-	42	100
Georgia	624	167	272	268	30	60	1421	96
Kentucky	271	55	35	43	30	43	477	100
Louisiana	371	94	108	119	14	1	707	100
Mississippi	392	86	-	-	-	-	478	80
North Carolina	299	93	87	85	7	56	627	90
South Carolina	229	83	84	76	24	-	496	50
Tennessee	1011	221	370	375	105	14	2096	100
Texas	474	87	167	185	35	21	969	100
Virginia	120	-	70	37	12	-	239	100
Subtotal	4528	1022	1466	1444	372	204	9036	
Federal-State Cooperative Stations:								
Brooksville, Florida	413	83	128	133	68	-	825	100
Jeanerette, Louisiana	238	122	86	99	46	-	591	100
Front Royal, Virginia	440	114	177	134	47	-	912	100
Subtotal	1091	319	391	366	161	-	2328	
Total	5619	1341	1857	1810	533	204	11364	

TABLE 2. Numbers of Animals Performance Tested and Slaughtered from S-10 Contributing Projects in 1964-1965

State	Performance Tested			Slaughtered		
	Bulls	Heifers	Steers	Bulls	Heifers	Steers
Alabama	41	103	95	5	0	86
Arkansas	233 <sup>1</sup>	79	0	58	0	3
Florida	-	-	-	-	-	-
Georgia	62	158	36	23	20	48
Kentucky	113	49	43	17	0	0
Louisiana	0	0	112	0	0	112
Mississippi	0	0	55	0	0	55
North Carolina	22	0	54	22	0	54
South Carolina	20	0	56	0	0	56
Tennessee	161	156	206	17	108	189
Texas	43	134	88	0	9	77
Virginia	0	37	70	0	37	70
Subtotal	695	716	815	142	174	750
Brooksville, Florida	74	124	34	12	41	34
Jeanerette, Louisiana	31	48	44	0	36	34
Front Royal, Virginia	49	116	66	-	-	66
Subtotal	154	288	144	12	77	134
Total	849	1004	959	154	251	884

<sup>1</sup>Includes 139 bulls owned by cooperating breeders but fed in cooperative centralized bull test.

TABLE 3. Funds Expended on Beef Cattle Breeding Research in S-10 Herds During the Fiscal Year Ending June 30, 1965

State	Regional Research Funds	AHRD Funds	State-Controlled Funds	Income from Cattle
Alabama	24,128.00		53,587.00	39,019.00
Arkansas	6,598.00		65,794.00	57,434.00
Florida	3,300.00		14,103.00	
Georgia	6,250.00	4,940.00	20,000.00	30,454.00
Kentucky	25,923.00		24,000.00	15,100.00
Louisiana	13,375.00		101,320.00	53,628.00
Mississippi	11,000.00		54,000.00	32,880.00
North Carolina	11,000.00	1,800.00	245,000.00	17,500.00
South Carolina	2,931.00		35,969.00	19,691.00
Tennessee	12,000.00	9,400.00	64,000.00	
Texas	15,195.00	13,200.00	122,072.00	55,942.00
Virginia	15,000.00	6,100.00	31,370.00	16,000.00
Brooksville, Florida		67,848.00 <sup>a</sup>	38,152.00	39,619.00
Jeanerette, Louisiana		53,300.00	80,300.00	25,400.00
Front Royal, Virginia		92,000.00 <sup>b</sup>	101,500.00	40,300.00
Total	146,700.00	248,588.00	1,042,167.00	442,967.00

<sup>a</sup>Includes a dwarfism allotment of \$2,500.00; expenditures made by Dr. Marvin Koger, University of Florida, Gainesville.

<sup>b</sup>Includes \$34,500.00 used in replacing main reservoir.



PROCEEDINGS  
S-10 TECHNICAL COMMITTEE MEETING  
Lexington, Kentucky  
June 6-9, 1965



PROGRAM  
S-10 TECHNICAL COMMITTEE MEETING  
University of Kentucky  
June 6-9, 1965

Sunday, June 6

Assemble and register at Kentucky Dam Village State Park

4:00 p.m. Committee meetings

7:00 p.m. Executive Committee meeting

Monday, June 7

8:00 a.m. Welcome to Kentucky

8:20 a.m. Announcements - E. U. Dillard and N. W. Bradley

8:30 a.m. Changes in Philosophy of Cooperating Groups and Personnel in S-10 - C. S. Hobbs

9:30 a.m. Questions and Problems Concerning Genetic Principles and their Application - J. L. Lush

10:30 a.m. Panel discussion and questions

11:45 a.m. Initial committee reports

    Data Collection and Analysis - T. B. Patterson

    Standardization of Carcass and Meats - C. S. Hobbs

    Annual Report Forms - C. J. Brown

12:00 noon Lunch

1:00 p.m. Leave for Princeton station

1:30 p.m. Tour of S-10 herd at Princeton and Kentucky station report - N. W. Bradley

3:30 p.m. Leave for Lexington

Tuesday, June 8

8:00 a.m. Station reports

    Alabama - T. B. Patterson

    Arkansas - C. J. Brown

    Florida - Marvin Koger

    Florida, Brooksville - W. C. Burns

    Georgia - W. C. McCormick

    Louisiana - Noah England

    Louisiana, Jeanerette - D. C. Meyerhoeffer

12:00 noon Lunch

1:00 p.m. Reports on present S-10 studies

1:30 p.m. Final report, Standardization of Carcass and Meats Committee - C. S. Hobbs

2:10 p.m. Final report, Annual Report Forms Committee - C. J. Brown

2:50 p.m. Final report, Data Collection and Analysis Committee - T. B. Patterson

3:30 p.m. Discussion of future projects and plans for S-10

4:00 p.m. Leave for Coldstream Farm

Wednesday, June 9

8:00 a.m. Administrative Advisor's Report - Doyle Chambers

8:30 a.m. Investigation Leader's Report - R. S. Temple

9:00 a.m. Report from AHRD - E. J. Warwick

9:20 a.m. Report from CSRS - M. J. Burris

9:40 a.m. Final business session

    Resolution Committee report

    Selection of site for 1966 meeting

    Old business

    New business

    Chairman's Report - E. U. Dillard

1:00 p.m. Optional tours to Merryworth Farms, horse farms, the agriculture experiment station, and other points of interest

S-10 TECHNICAL COMMITTEE MEETING  
Lexington, Kentucky  
June 6-9, 1965

The 1965 meeting of the S-10 Technical Committee was held at the University of Kentucky in Lexington, and at Kentucky Dam Village State Park near Princeton, Kentucky. (See program for schedule of events)

Dr. E. U. Dillard, Chairman, presided over the meetings. Dr. N. W. Bradley, acting as host, and Dean W. A. Seay welcomed the group to Kentucky.

Those attending the meetings were:

<u>Name</u>	<u>Institution</u>	<u>Location</u>
T. B. Patterson*	Auburn University	Auburn, Alabama
C. J. Brown*	University of Arkansas	Fayetteville, Arkansas
W. C. Burns	West Central Fla. Exp. Sta.	Brooksville, Florida
F. M. Peacock	Range Cattle Exp. Sta.	Ona, Florida
A. C. Warnick****	University of Florida	Gainesville, Florida
W. C. McCormick*	Georgia Coastal Plain Exp. Sta.	Tifton, Georgia
T. M. Clyburn	Georgia Coastal Plain Exp. Sta.	Reidsville, Georgia
N. W. Bradley*	University of Kentucky	Lexington, Kentucky
Paul Appel	Western Kentucky Substation	Princeton, Kentucky
Dudley Arnett	University of Kentucky	Lexington, Kentucky
C. E. Barnhart	University of Kentucky	Lexington, Kentucky
R. H. Dutt	University of Kentucky	Lexington, Kentucky
W. P. Garrigus	University of Kentucky	Lexington, Kentucky
Roy Gray	University of Kentucky	Lexington, Kentucky
Dave McKechnie	University of Kentucky	Lexington, Kentucky
J. R. Overfield	University of Kentucky	Lexington, Kentucky
D. G. Steele	University of Kentucky	Lexington, Kentucky
J. T. Thompson	University of Kentucky	Lexington, Kentucky
Doyle Chambers**	Louisiana State University	Baton Rouge, Louisiana
N. C. England*	Louisiana State University	Baton Rouge, Louisiana
D. C. Meyerhoeffer	Iberia Livestock Exp. Sta.	Jeanerette, Louisiana
Hollis Chapman	Louisiana State University	Baton Rouge, Louisiana
S. H. Fowler	Louisiana State University	Baton Rouge, Louisiana
Don Franke	Louisiana State University	Baton Rouge, Louisiana
A. M. Mullins	Louisiana State University	Baton Rouge, Louisiana
G. L. Robertson	Louisiana State University	Baton Rouge, Louisiana
C. E. Lindley*	Mississippi State University	State College, Mississippi
E. U. Dillard*	North Carolina State	Raleigh, North Carolina
W. C. Godley*	Clemson University	Clemson, South Carolina
J. R. Hill	Clemson University	Clemson, South Carolina
C. S. Hobbs*	University of Tennessee	Knoxville, Tennessee
W. T. Butts, Jr.	University of Tennessee	Knoxville, Tennessee
T. C. Cartwright*	Texas A and M University	College Station, Texas
T. J. Marlowe*	Virginia Polytechnic Institute	Blacksburg, Virginia

<u>Name</u>	<u>Institution</u>	<u>Location</u>
Gary Richardson	Virginia Polytechnic Institute	Blacksburg, Virginia
Ruel Wilson	Virginia Polytechnic Institute	Blacksburg, Virginia
M. J. Burris	USDA, CSRS	Washington, D. C.
R. P. Lehmann	Biometrical Services, ARS, USDA	Beltsville, Maryland
R. H. Miele	Biometrical Services, ARS, USDA	Beltsville, Maryland
E. J. Warwick	USDA, ARS, AHRD	Beltsville, Maryland
R. S. Temple***	USDA, ARS, AHRD	Knoxville, Tennessee

\* - Technical Committeeman  
\*\* - Administrative Advisor  
\*\*\* - Investigations Leader  
\*\*\*\* - Representing Dr. Marvin Koger

EXECUTIVE COMMITTEE MEETING MINUTES

7:00 p.m., June 6, 1965  
Kentucky Dam Village, Kentucky

Executive Committee Chairman, E. U. Dillard, presided.

Others present - C. J. Brown, Noah England, Doyle Chambers, R. S. Temple, E. J. Warwick and N. W. Bradley.

Dr. Bradley elaborated on plans and arrangements made by the Kentucky station. He indicated the location for the Monday morning meeting, outlined the tour of the Western Kentucky Station, and gave directions for travel to Lexington. Reservations were at the Center Motel in Lexington and meeting rooms were in the Kentucky Animal Science Center.

After some discussion it was agreed that meetings would be scheduled on Central Standard time on Monday and during the Western Kentucky Station tour, but Eastern Standard time would be used at Lexington for the remainder of the meeting.

It was agreed that the meeting would start at 8:30 a.m., Monday, rather than at the scheduled time because Dr. Hobbs had not arrived and would not be present for his presentation on Monday.

Dr. Dillard proposed changes in the standing committees to include all technical committeemen on a committee, retain only one member on each committee for a two-year period, and remove all non-technical committeemen from committees. These changes were approved by the Executive Committee.

Dr. Chambers asked about the policy of the Technical Committee in regard to state project review under the new regional project revision. After discussion, the following statement was approved. "Any new project or revision shall be reviewed by the Executive Committee and approved by the Technical Committee. It is further recommended that sufficient time be allowed for review prior to the annual meeting."

Dr. Warwick inquired about the format and interpretation of the "multiple-use reports" that are circulated. He also asked whether all state work or only USDA work should be included in this report. The general consensus of the discussion which followed indicated no criticism of the present format, although there was some possibility of the uninformed misreading or misinterpreting the Federal-State relationships involved. It was agreed that there was no reason to bring this before the Technical Committee.

Dr. Chambers mentioned that the Committee of Nine suggested that S-10 and S-19 work be more closely coordinated. It was mentioned that Dr. Warwick and Dr. Kincaid were present at the organization of S-19.

Dr. Warwick raised a question concerning provision for an ARS signature on the new regional revision. Dr. Chambers stated that ARS participation was handled in the project statement in the same manner as a contributing state. Dr. Temple was to further check this point with Dr. Burris.

The meeting adjourned at 9:30 p.m.

Respectfully submitted,

C. J. Brown, Secretary

### Committee Assignments for 1965-66

#### Data Collection and Analysis Committee

W. C. Godley, Chairman  
T. C. Cartwright  
N. W. Bradley  
W. C. McCormick

#### Standardization of Carcass and Meats Committee

C. E. Lindley, Chairman  
E. U. Dillard  
C. J. Brown  
T. B. Patterson

#### Annual Report Forms Committee

J. A. Gaines, Chairman  
Marvin Koger  
C. S. Hobbs

#### Project Revision Committee

T. C. Cartwright, Chairman  
C. J. Brown (as Chairman of Executive Committee)  
R. S. Temple

MINUTES OF S-10 TECHNICAL COMMITTEE MEETING  
University of Kentucky  
June 6-9, 1965

The S-10 Technical Committee met at 8:30 a.m., June 6, 1965, in a meeting room at Ken-Lake Bowling lanes near Kentucky Dam Village. Chairman E. U. Dillard introduced Dr. Charles Barnhart, Associate Director of Kentucky Experiment Stations, who welcomed the group and described the Kentucky livestock research program at different locations in the state. After announcements by N. W. Bradley and R. S. Temple, Dr. Dillard introduced Dr. J. L. Lush who gave a very stimulating talk on "Questions and Problems Concerning Genetic Principles and Their Application." A copy of this talk will be included in the 1964-65 annual report. The remainder of the day was devoted to preliminary committee reports, a tour of the Western Kentucky Experiment Station at Princeton, and travel to Lexington.

Tuesday and Wednesday sessions were held at the University of Kentucky Agriculture Science Center, Lexington, Kentucky. These meetings proceeded according to the program included with this report. Dean W. A. Seay of Kentucky extended a welcome to the group and commented on the development of the livestock industry in Kentucky. Station reports and final reports of standing committees were presented. Copies of these reports are attached. In addition to the scheduled reports, T. C. Cartwright of Texas made a progress report on the study of cow size, by H. A. Fitzhugh. He requested information to aid in interpretation of preliminary results. Also, R. S. Temple reported on the progress of Haley Jamison in the analysis of his data. A tour of the cattle facilities at Coldstream Farm was made at 4:00 p.m.

Dr. Doyle Chambers, the new S-10 Administrative Advisor, expressed his appreciation at being associated with S-10 and commented on the potential of the Southeast in livestock production. The requirements of funds and facilities for research to aid in the transition from a row crop agriculture were cited. At present, about \$146,000 in Regional Research Funds; \$1,042,000 in state controlled funds; and \$250,000 in AHRD funds are devoted to efforts of this regional project. Dr. Chambers also commented on the development of beef cattle germ plasm and the appropriateness of the remarks of Dr. Lush. He pointed out that directors can support best the programs of research where industry is using the information.

Dr. Temple expressed appreciation for cooperation he had received from the Technical Committeemen and the Administrative Advisor. His report concerned time spent on project revision, the reproduction bulletin, the cow size study, reduced budget support, the basic beef cattle genetics laboratory, annual reports, and closer cooperation among the states.

Dr. E. J. Warwick spoke to the group regarding the history and progress of research in beef cattle breeding in S-10. He further commented on legislation introduced regarding humane treatment of laboratory animals, the problems of residue in slaughtered cattle that have received drugs, the status of semen importation, and difficulties in obtaining funds. He emphasized the need for work on problems unique to cattle and on problems where cattle are the best

laboratory animals. He noted the fact that the elite seed stock herds have made less use of the S-10 research than commercial operators. There are at present about 400,000 cows on performance test under Extension Service supervision. An effort to standardize procedures of performance testing is being made under the leadership of Dr. Frank Baker.

Dr. Martin Burris, of CSRS, remarked on the need to report more results and less interpretation. He also emphasized the need to work on problems requiring beef cattle and pointed out the possible alternative use of laboratory animals. He commented on pooling of data and the need for better utilization of records. He also outlined his current study being carried out at Purdue with *Tribolium*.

Dr. C. S. Hobbs spoke briefly to the group concerning "Changes in Philosophy of Cooperating Groups and Personnel in S-10."

The Technical Committee was declared to be in business session at 10:15 a.m. on Tuesday, June 8.

Assignments of members to the various committees were announced during the business session. A list of the 1966 standing committee members is attached. All committee reports for 1965 will be included in the annual report.

Dr. Patterson moved acceptance of the report of the Data Collection and Analysis Committee. The motion was seconded by Dr. Godley and passed.

Dr. Brown moved acceptance of the Annual Report Forms Committee report. The motion was seconded by Dr. Lindley and it passed.

Dr. Hobbs moved acceptance of a modified report of the committee on Standardization of Carcass and Meats. This motion was seconded by Dr. Cartwright and was passed.

Dr. Cartwright extended an invitation for the Technical Committee to meet in Texas in 1966. Dr. Hobbs made a motion that the Texas invitation be accepted. This motion was seconded and passed. Dr. Hobbs extended an invitation for the group to meet in Tennessee in 1967. A motion was made by Dr. Godley and seconded by Dr. Lindley to accept the Tennessee invitation for 1967. Representatives from Florida and Louisiana expressed a desire for the Technical Committee to meet at their stations soon.

Dr. Chambers mentioned the need to make some minor changes in the revised S-10 project outline. A change in the Alabama statement was also discussed. Other changes or corrections must be received by the Investigations Leader within the next ten days in order to be included in the final outline.

A motion was made by Dr. Brown to accept the minutes of the February Executive Committee meeting which have been distributed. Motion was seconded by Dr. Marlowe and motion passed.

Dr. Lindley was elected to the Executive Committee as Secretary to replace Dr. England, who is leaving Louisiana State; and Dr. Bradley was elected as the committeeman-at-large.

Dr. Cartwright indicated that Mr. Fitzhugh needs more information in his study. He also reported that Dr. D. F. Weseli has been hired to work on the Basic Beef Cattle Genetics study and about 100 cows have been assigned to this project.

Dr. Godley presented the report of the Resolutions Committee and moved that it be accepted. Dr. Brown seconded the motion and it passed. This report is attached.

Dr. Dillard expressed appreciation to the group for their cooperation, individual effort, and exchange of ideas during his year as Chairman.

The meeting adjourned 11:45 a.m., June 9.

Respectfully submitted,

C. J. Brown, Secretary

Report of the Data Collection and Analysis Committee

Subsequent to the discussion on Tuesday, June 8, 1965, the following recommendations were made:

1. That the Investigations Leader prepare a project outline stating the objectives and probable analysis procedures to be used in connection with the proposed fertility study for the S-10 group.
2. That the project outline be circulated among the Technical Committee members and suggested changes be considered.
3. That the Executive Committee be responsible for the final decision with regard to this study.
4. That the decision to furnish data to such a study be left up to the Technical Committee member from each state.
5. That the Technical Committee member be notified as needed on the progress of the study.
6. That, should the information obtained from this proposed study so indicate, consideration be given to development of a project outline with specific objectives for future studies.

7. That consideration be given to establishing fertility projects at one or more stations and that the following suggestions be given consideration in establishing such projects:

Suggestions:

- (a) A 365-day breeding season should be used.
- (b) Multiple-sire herds or some method of eliminating sire effects should be used.
- (c) No culling should be made for reproductive performance.

Respectfully submitted,  
T. B. Patterson, Chairman  
T. C. Cartwright  
Noah England  
W. C. Godley

Report of the S-10 Committee on Carcass and Beef Standardization

I. A. Live animal evaluation

- 1. Subjective scores are suggested for type, condition, grade, and meatiness, (use estimated yield grade).
- 2. Accurate and standard off-feed and water weight and kill weight, with a standard pre-slaughter shrink (approximately 12 hours) are suggested.

It is suggested that weighing procedures as adopted by the Beef Cattle Records Committee (February 1965) be used for end of test weight; weigh off test by using an average of two weights taken on successive days after a minimum of 12 hours off feed and water before each weight; use either an individual weight at the packing company or home weight less a standard shrink in transit to market to determine dressing percent.

B. Minimum Standardized carcass observations

It is recommended that the following be taken:

- 1. Hot and chilled carcass weight (where only hot weight is available then shrink carcass weight 2.5 percent for yield to get a standard chilled carcass weight.)
- 2. Other components of USDA cutability groups, (as published in 4-7-65 Federal Register).
  - a. Single fat thickness measurements of the 12th rib at a point 3/4 of the length of the l. dorsi from the chine bone end;

- b. L. dorsi area at the 12th rib measured on the carcass and a tracing of ribeye including fat covering;
- c. Percent kidney, pelvic, and heart fat.

3. Carcass grade (USDA grade and/or carcass committee grade if possible)

Include:

- a. conformation
- b. maturity
- c. degree of marbling
- d. final grade (composite)

4. Subjective marbling score based on the 10 descriptive adjectives from the new USDA beef grading standards: abundant, moderately abundant, slightly abundant, moderate, modest, small, slight, traces, practically devoid, or devoid. An illustrated chart can be obtained from USDA.

C. Standardized palatability procedures

- 1. It is suggested that the carcass or 12th rib be aged for 7 days at 2 to 3°C. before standardization for cooking and shearing tests.
- 2. The 12th rib (minimum of 1-1/4 inch thick) should be frozen by rapid freezing and stored at -17 to -18°C. until cooked.
  - a. Meat for cooking and shearing tests should be cooked from the frozen state in a 149°C. oven to an internal temperature of 70°C.
  - b. SM-19 recommends thawing in refrigerator (42 to 45°F) for 15 to 18 hours before cooking.
- 3. Remove 1-inch cores from lateral, medial, and dorsal area of L. dorsi exercising care to avoid connective tissue membrane or fascia and large areas of fat. Core with "grain" of meat. Using Warner-Bratzler shear, make a minimum of two shear readings per core (a minimum of six shear readings.)

D. General suggestions

The above minimum data would enable research workers to estimate the following carcass factors:

- 1. USDA cutability grade and percent yield of bone-in or boneless retail cuts.
- 2. Performance Registry International certification requirements.

3. Pounds of lean in one side of carcass (University of Tennessee simplified method).
4. Carcass yield (figured either on chilled carcass weight or hot carcass weight minus 2-1/2 percent).
5. Estimation of consumer acceptance based on tenderness as measured objectively by Warner-Bratzler Shear.
  - a. If an additional measurement of the trimmed round is secured, these data can be used to comply with the Angus and Hereford Association carcass recommendations. In addition, percent yield of retail cuts can be estimated, based on Wisconsin system.
  - b. None of the proposed standardized techniques are in conflict with those proposed by AMSA, P.R.I., USDA, or Beef Cattle Records Committee.

For those desiring additional information and suggestions, but not required as a minimum, please see S-10 1959 Annual Report for proceedings of the S-10 Technical Committee meeting at Stillwater, Oklahoma, July 25-27, 1960, page 196-197.

Respectfully submitted,  
C. S. Hobbs, Chairman  
R. J. Cooper  
W. C. Godley  
E. U. Dillard

Report of the Annual Report Forms Committee

This committee recommends that the forms presently being used in the preparation of the 1964-65 annual report be retained, with minor modifications in footnotes to clarify the meaning of certain entries. These modifications will be worked out by the committee and the Investigations Leader.

Respectfully submitted,  
C. J. Brown, Chairman  
T. J. Barnes  
Marvin Koger

Report of the Resolutions Committee

The report of the resolutions committee was as follows:

BE IT RESOLVED that the S-10 Technical Committee express its appreciation to Dr. W. P. Garrigus and his entire staff - and especially to Dr. N. W. Bradley - for the warm hospitality, excellent facilities and arrangements, and well-planned tours during the Technical Committee meeting at Kentucky.

BE IT FURTHER RESOLVED that appreciation be expressed to Mr. Paul Appel and his staff at the West Kentucky Substation, Princeton, Kentucky, for arranging the tour of that station. Be it further resolved that a copy of this resolution be sent to Dr. W. A. Seay, Dean and Director, College of Agriculture, and to Dr. C. E. Barnhart, Associate Director, Kentucky Agricultural Experiment Station, as well as to the Animal Science Department.

BE IT FURTHER RESOLVED that S-10 Technical Committee express its appreciation to the Kentucky Cattleman's Association for the wonderful steak fry and additional entertainment Tuesday evening, and to the Fischer Packing Company, Louisville, Kentucky, - and specifically Dr. A. R. Parsons, a former S-10 Technical Committeeman, for securing and preparing the steaks served during the steak fry. Be it further resolved that a copy of this resolution be sent to Mr. Robert Hicks, Midway, Kentucky, President of the Kentucky Cattleman's Association, and to Dr. A. R. Parsons, University of Kentucky.

BE IT FURTHER RESOLVED that the S-10 Technical Committee express appreciation to Dr. J. L. Lush for his outstanding contribution to Animal Breeding Research in general, and especially for his excellent presentation during the program and that the Secretary express our gratitude to Dr. Lush by letter.

BE IT RESOLVED that the S-10 Technical Committee express to Dr. Noah England its sincere appreciation for his contribution to S-10 and to the beef cattle industry. Dr. England is leaving the Committee due to a change in his employment status. Therefore, the Resolutions Committee recommends to the Technical Committee that we adopt this resolution and wish Dr. England Godspeed and good luck in his new position.

Respectfully submitted,  
W. C. Godley, Chairman  
C. E. Lindley  
W. C. McCormick

## PROBLEMS CONCERNING GENETIC PRINCIPLES IN ANIMAL BREEDING<sup>1</sup>

J. L. Lush  
Animal Science Department  
Iowa State University

One can understand the principles of a situation clearly and yet not be able to change the situation to one's own advantage. Astronomy and the process of Mendelian segregation are two widely different examples.

Conversely, one can sometimes control a situation without understanding the principles involved. This happens often in the early stages of a science. Then the knowledge is almost all empirical and was gained by fairly simply conceived trials and (usually!) errors. Alchemy is an example. When its principles became clear enough, they changed its name to chemistry to get away from the unsavory reputation which went with the older ideas known collectively as alchemy. Much of the practice of medicine before Pasteur also rested only on empirical knowledge. The further progress of a real science consists almost wholly of discovering the principles and verifying those in the real world. Of course, devising successful applications requires something more - often far more - than merely understanding the principles correctly.

### Some genetic principles which seem to need more clarifying.

1. What causes the gap between predicted and realized gains from selection? Are we often far off base when we estimate "heritability", compute the selection intensity we practice, and then proceed as if the actual gains would be exactly like those we estimated, plus or minus only the sampling variations which are purely chance?

2. What are the real causes of genetic correlations, especially of the negative ones? Pleiotropy, of course, looms large as a possibility. What else?

3. What are we up against if many of the things for which we select have a small negative genetic correlation with numerous of the constituent parts of "fitness"?

4. What are the consequences if many alleles are possible in nearly all loci and often several of them are nearly equal in frequency? Suppose most of these "isoalleles" show overdominance with each other and their effects are so nearly alike that we cannot detect the difference between them in a Mendelian manner and would not know that the locus exists were it not for the other allele which produces a strikingly different effect, usually a definitely undesirable one?

5. To what extent is heterosis incompatible with all of the genetic variance being additive? Can one be consistent and believe simultaneously that heterosis and crossbreeding are important and yet that selecting for good individual performance will also achieve superior special combining ability? What kind of genetic situation or background could make this

<sup>1</sup>Paper presented at the S-10 Technical Committee Meeting, June 6-9, 1965, Lexington, Kentucky.

possible? Can heterosis have any other explanation except a mixture (in some proportion) of overdominance and epistasis? Doesn't linkage between favorable and unfavorable genes, with the repulsion combinations being in excess of a random fraction, amount to the same thing as overdominance operationally - at least over the next few generations?

Parameters which need estimating more precisely.

1. More studies of heritability are needed. Some traits have not yet been studied. The confidence intervals of others need narrowing and their mean values need revising. Does "heritability" really differ in different genetic groups or in different environmental situations? What really is in our estimates of it? How much is really epistasis? How much is really interaction between heredity and environment?

2. Are interactions between environment and heredity anything other than the inability of the variety or breed to adapt well to a wide range of environments? Do cattle show less of this interaction than do sheep? Where this interaction is real and important, can one combat it in any way except by breeding special breeds for special purposes? Could it be eliminated by breeding for general adaptability?

3. How large are the genetic correlations between desired traits, especially the negative ones?

4. To what extent is "genetic slippage" caused by negative genetic correlations between the things for which we are selecting and other unnoticed aspects of "fitness"?

5. To what extent are "sign characters" really useful? Are they useful in those cases because of genetic correlations or because the sign characters indicate some unmeasured environmental variations for which correlation should be made?

Problems of application.

Fitting the facts of estimates of parameters together into a smoothly working plan offers plenty of problems. Local conditions, costs, and market preferences often make these vary distinctly, even between nearby regions. H. B. Phillips wrote in 1954 (American Scientist 33:258-9): "A study of science indicates that the structures now used are of two types. First are those which involve only a small number of variables, each of which has an individual function. This includes most of present-day engineering. Second are structures which involve an uncountably large number of variables, but in which only average values are used. Such are the atomic systems of thermodynamics and major fields of economics. Between these extremes are structures which involve a very large number of variables, each of which has an individual assignment. Illustrations are the hereditary units or genes in biology. A little consideration of the nature of numbers and combinations of numbers will show that this intermediate domain is indefinitely larger than the two ends. Relative to such matters we are like the builder who might say, 'I know how to make perfect bricks. Cities and towns are mere piles of brick.' So we know how to make certain elementary combinations. Assembling these into structures of unlimited complexity is a work of the future."

1. Refining and perfecting selection indexes offers an infinite field of possibilities. Perhaps we will soon come up to the law of diminishing returns in working on those, or perhaps they will get more profitable the further we pursue them.

2. Rotational crossbreeding, using whatever breeds already exist, has long been practical with beef cattle to a limited extent (blue-grays, Frank Hastings, and the 10 percent undercurrent of Shorthorn blood in the SMS herd, Brahmans on the Gulf Coast, etc.) Other than this, schemes or breeding plans for utilizing still better whatever dominance and epistatic variance exists have barely begun with beef cattle, although they have been so conspicuously successful in corn breeding for the last 50 years and in poultry breeding for nearly 30 years. Are the costs really insuperable and the benefits really so small that this would be fruitless? Or would a little ingenuity pay handsomely in planning how to skim much of that cream without raising costs exorbitantly?

3. How much genetic improvement can really be gained by artificial insemination? The topic has a remarkable ability to awaken interest, even though no one claims it would change a single gene in a single gamete directly. Its phenomenal spread with dairy cattle is due largely to the almost universal desire of dairymen to get rid of the bull. Breeders of beef cattle have only a little of this feeling. Also their costs would be higher because of the extra attention they would need to give their cows. The probable genetic gains from artificial insemination come only in two ways. First is the larger selection differential possible among the bulls when fewer need to be saved. This is real, although smaller than many might think. For instance, saving the best 1 percent instead of the best 20 percent would make the selection differential for bulls about 1.9 times as large, but this applies only to the half of the inheritance which comes through the bulls. Also it overlooks the fact that under natural service the improvement wrought in the "elite" herds ultimately spreads through the whole breed. Perhaps this question about the possibilities for improvement which artificial insemination offers has different answers if we ask it for the immediate future or if we ask what we can do in the long run. The other possibility is that standards of what is "best", or the accuracy of estimating that, will change if sire selection is done by the experts on a sire selection committee instead of by each individual breeder himself. But, as Kipling might have said, that is another story. It has real possibilities but they seem (to me) small, at least for traits with heritabilities above 0.1 and observable in both sexes. And part of the price is that fewer different sires would get tried in the first place. Therefore, the chance of the breed eventually cashing in on "a long shot" would be diminished. But perhaps that chance isn't really worth enough to mourn its decrease.

4. Changes in economic demands and in production methods may change our ideals. Will we begin to feed bulls instead of steers? If so, how soon? In Europe east of France and Britain all feeding of beef cattle is of bulls. Bulls gain faster on less feed and produce leaner carcasses, but, then, people keep few bulls on feed to ages much older

than 12 or 13 months. Perhaps that does not fit our situation. Steers are fed in France and Britain but these are often one and a half or even more than two years old before they are killed. M. Dumont, a leader of France's research with beef, told us at Mariensee in 1961 that within 10 years we would pay no attention at all to breeding cattle for palatability or for conformation. He said he would get palatability by aging the meat and by using tenderizers. Conformation would no longer be pertinent on the meat market because the customer would no longer even know or care what conformation the original carcass had. Most of his listeners disagreed, but he stood his ground. Can he be right?

5. Will the races of cattle bred for milk continue to become more divergent from the races which are bred primarily for beef? In this country the trend has been in that direction for as long as I can remember, even though most of the arguments concerning net profit seemed to favor the dual-purpose kind. Will the trend in that direction continue? Or was that (like many other trends) a curvilinear one which may turn back in the other direction?

6. I feel certain that cattle will never again be bred for draft purposes in the United States. The inventors and engineers who develop tractors and similar sources of mechanical power will keep ahead of that. But need this be true of all the less-developed countries? For instance, will India ever cease to use cattle as the main source of power in agriculture? Some 11 years ago, I spent a most interesting evening listening to a half-dozen of the leaders of the Indian State of Rajasthan discuss this topic. One insisted that cattle would almost cease to be used as power on the farms of India within the life-times of most of us then in that room. All others disagreed. They challenged him to show how that could possibly happen. He admitted he could not tell them just how it would be done, but he named many changes which he had already seen in the use of bullocks within his own 40 years. He was sure that if garden tractors, lawnmowers, and the like would improve as much in the next 10 years as they had in the past 10, this would make mechanical power possible even on the two and three-acre farms of India. I have not been back since. I do not think I would notice much change if I could go back. Yet, how certain are we that such a change could not happen within perhaps the next 15 or 20 years?

#### Problems of conducting the research.

1. How long should one stay with a project before revising it? When the generation interval is nearly 5 years, what kinds of research with beef cattle breeding are worth starting at all, if one does not expect to stay with them at least 12 to 15 years. Yet, to ask our administrators to approve a research project which would first begin to yield results 20 years from now is almost like asking them to approve a lifetime pension for the research worker who is to conduct the project. Most administrators are understandably reluctant to embark on that! Their reluctance is enhanced by the propensity of research workers themselves to change their minds about what they want to investigate, and by the statistical certainty that many of them will move to another position

within the next 10 or 15 years and leave the project behind. Many of you will be under some pressure to drop the old experiment and try something new, even though you have spent much money and time on the old one and it may be about to start yielding information. Sometimes all this pressure to try something new comes from within the research worker himself. We get impatient. Fashions in research do exist. The temptation to join "the gold rush" is strong. Then, too, our administrators may apply some external pressure if they are sympathetic with the journalistic outlook. Few things are more useless than yesterday's newspaper or last year's magazine!

Yet, questions which are peculiar to beef cattle simply must be solved by research on beef cattle, no matter how long the generation interval or how expensive the research. If the question we are asking is one of genetic principles, very likely it can be solved on mice or other laboratory organisms more cheaply and quickly and with less risk of the project being lost through change of personnel. Such use of laboratory animals for "pilot experiments" seems to deserve wider use than it yet receives. Yet when the pilot experiment has done all it can to clarify the principles and show us where our original plans or thinking were hazy or wrong, a question peculiar to beef cattle requires at least to be verified by research on beef cattle.

2. Where is cooperation between different stations needed most? Is mere replication almost all which is really productive? After all, is it really possible to interpret unmistakably the results of an experiment which was conducted partly at one station and partly at another? Correction factors, deviations from contemporary herd averages and similar devices are often helpful, but can they eliminate enough of the effects of unnoticed differences between stations that the findings will add dependable new knowledge?

3. All our experience indicates that we should exchange research information freely with each other. The major gain, so far, from all our cooperation in regional research seems to have come from the pooling of information which comes when groups of specialists in a kindred field, such as you are, get together and recount their new difficulties and otherwise let down their hair and cry in their beer! At meetings such as this, holding back any information you already have, in the fear that someone will "scoop" you, is worse than useless. When you lock the laboratory door, you lock out more than you lock in.

4. Conducting a project in applied research is almost certain to raise basic questions which demand answers. Projects intended primarily to study the basic questions will sometimes solve a problem of application. Each line of endeavor feeds ideas to the other. In general, the applied worker seems (to me) to feed more problems to the basic worker than the latter feeds solutions back to the man in applied research. In any event, it is profitable for both men to keep in touch with the other field - at least afar off. If they understand each other well and make an effective team, that is still better, of course. But each must know something of the other's field if they are to communicate. It is not enough for one

to know the field up to a certain point and then have the other know only the rest. As in grafting scions to rootstocks, they need to overlap each other considerably if the necessary amount of osmosis and interchange of ideas and enthusiasm is to take place.

5. Each research worker should have at least a little time free to do research entirely on his own. That helps keep him in the proper frame of mind to be a helpful member of the team. For instance, the duties of a substation superintendent may be little more than to manage the animals and to collect the prescribed data in projects planned and interpreted by someone at the central station. Yet, if that substation superintendent has a small project of his own in which he has complete authority to do whatever he pleases, this will usually pay off in making him a better helper in the main projects, even if his own project never does, of itself, uncover much which is worthwhile. Letting him have that little project of his own is a bit like putting oil in your automobile engine; you don't get any power directly out of the oil, but you do get much better engine performance if you put it in just the same! Similar things might be said concerning men located at the main station. Imagine that you are a cautious head of the Animal Husbandry Department and you feel the weight of responsibility heavy on your shoulders. Why not give your animal breeding man full responsibility for guiding the breeding in at least one breed of the college herds or flocks? What if he does pick the wrong bull and spoil the herd? You would probably pick a different bull and spoil the herd just as badly, although in a different direction. Possibly the risk is a little less when you do it, especially when your breeding man is new. My point is that making the decisions which such responsibility would throw in his lap will give him a better sense of proportion about what are and are not the important problems with which breeders must grapple. This can hardly fail to make him a better teacher, at least. Even if his unwise actions do make the herd a little less meritorious than you could have made it, isn't that likely to be a small price for making him a much better teacher? And, of course, he just might do a better job than you really would! Isn't there food for deep thought in the fact that so few animals bred in university or federal herds have every had detectable direct influence on any breeds in the United States? And the situation is similar in nearly all other countries. I think I could count all the exceptions on the fingers of one hand. And the situation is so different with oats, wheat, and soy beans. Doesn't it fairly clamor for an answer to the question: Why?

6. How many annual reports per year do you write to how many different supervisory, coordinating, or administrative agencies? What fraction of your time does this take? Who reads these reports, besides you and your secretary? I know as well as anyone that most of us are lazy in one way or another and that some virtue resides in having to work under the whip of a dead-line. Yet, I am appalled at the total amount of time spent in preparing reports. Recently we moved into new offices and I had some valid physical reasons for asking searchingly whether any annual report as much as five years old was really worth shelf space. The time spent preparing annual reports doesn't seem large if expressed as a percentage of our total time. But if from our total time we first subtract 30 percent for just keeping the routine wheels turning, 40 percent for

teaching, 15 percent for correspondence, and 5 percent for cruising around in the library, how does the time spent in preparing reports loom as a fraction of the free remainder? I don't see how we could get along without them as devices for making us keep our work tidied up, but I wish there were some way they could be prevented from requiring so much of our efforts.

Sample details often needing more attention in research or in publication.

1. The additive effect is a mathematical abstraction or partial description of a swarm of biological facts about that population. Often the actual effect of a gene varies from individual to individual according to what other genes are present and according to the environment which prevails. When we divide the total effects of a gene into (a) additive, (b) dominance, (c) epistatic, and (d) interactions with the environment, the division is in our minds and for convenience in our analysis; it is not in the genes themselves. This statistical division is useful for many purposes, some of which are important in framing our breeding plans, but our writing is likely to be clearer if it shows that the division is one we made in an effort to describe in simple terms as much as we can of the often complex functioning which is the reality in nature.

2. Often we sin against our reader or listener by stating our thoughts in ways needlessly hard for him to understand. The joint result is that he understands less than he should of what we really could have told him and we do not get full credit for what we did try to say. A few of those details which recur frequently are as follows:

a. "Not significant" really means "not proven". It does not mean that the most probably value of a difference is zero. The most probable value of the difference is the value we found, provided we did our best to do the experiment fairly and without bias, although, of course, we want to average our findings in with other human experience unless this is one of those rare cases where no other experience already exists. Really we test for significance only to decide whether to get excited about our results. Deming says, in connection with quality control: "An economic balance must be struck between the two kinds of errors - looking for trouble that does not exist, and failing to look for trouble that does exist."

b. We weary our readers with foolishly long decimals. As a useful guide, I like Kelley's rule. This is that a figure should be published only to the first digit of one-third of its standard error. As some horrible examples of decimals published to a silly degree, I take the following - although I'm sure some still more extreme ones might be found also. (I hope you will be kind enough not to scrutinize my own earlier writings!) In USDA Technical Bulletin 1027 concerning remedial treatments tested on some cows, we are told that treatment was effective in eliminating:

64.86 percent of 37 streptococcal infections and  
33.33 percent of 9 staphylococcal infections.

Since one animal more or less would have made a difference of about 3 percent in the first group and 11 percent in the second group, there was no point in publishing any decimals at all. In the Journal of Agriculture Research

in 1931, some Minnesota workers in nutrition report that a correlation (computed on 16 items!) was  $.53136 \pm .11736$ . At a Dairy Science meeting a few years ago, one man reported that the rainfall varies from 58.46 inches to 14.47 inches at the same locality. This gave him a range of about 4400 classes! Lest you think that workers in agriculture are the only sinners in this respect, I refer you to the American Naturalist 67:570 where you can read concerning the results of treating some flies, that:

$$\frac{24}{176} = 13.6363 \pm 1.74466 \text{ percent showed some somatic deformities"}$$

Printing these meaningless decimals does several things: (1) it increases the printing costs, (2) it makes the report harder for the reader to follow, and (3) it suggests to many readers that the writer really doesn't understand what numbers may mean or else that he absent-mindedly left his calculating machine running and thoughtlessly copied the results without considering what they might mean! I can't believe that the editors or the typesetters make us use all those decimals, although editors do have some justifiable standards about uniformity of the tables they print.

c. One still sometimes sees or hears the misleading innuendo that: "There is more variation within breeds than there is between breeds." The objectionable innuendo is its implication - to many - that the breeds do not really differ. The writer didn't actually say this; he just seemed to! What real purpose does such an expression serve? Perhaps the writer or speaker is trying to carry water on both shoulders? That can get uncomfortably close to being dishonest. Could he really be so naive that, like many of the general public, he really does think that two groups are not different if they overlap at all? The most elementary experience with the standard error of a mean should long ago have corrected that.

d. We put too much on a lantern slide. Then we compound the crime by making that slide too small.

e. We do the same thing with tables in a printed article. The crime is not quite so serious here because those few readers who really do want to know the details can take time to do that. Still, we might often do well to ask ourselves: What is the one - or at the most, two - ideas I really want most to show with this table?

f. An improvement in grammar, or at least a happier choice of words, will often help our reader or listener understand with fewer mistakes what we really meant to say. If we have been immersed in many classes of mathematics or statistics, we are likely to say "greater" when we really mean "larger". In everyday language, "great" often implies eminence and not merely magnitude. We use pronouns and long strings of nouns as adjectives. I think the former is never permissible, yet I sometimes see a thesis with such expressions as "the between cow within sire variance is". All of us sometimes use nouns as adjectives one at a time. Occasionally using two of them seems the only way to avoid an awkwardly long expression. Sometimes I see strings of as many as 4 or 5 nouns, all used as a kind of compound adjective. We use strings of long words when fewer short ones would do as well. For instance, we say

"associated with" when "of" would do as well and would not also imply the human comradeliness of sociology! Recently I read for entertainment, but somewhat critically, Rouse's "The March Up Country", which is a translation of Xenophon's story of the Retreat of the Ten Thousand. Now I understand better why so many of the Greek writings are still regarded as classics after more than 2000 years - they packed so much into so few words and they said it so directly. We abuse or overwork the word "estimate" when we really mean "compute" or "calculate". To the general public, "estimate" still sounds much like "guesstimate". Why handicap our message in that way? "Estimate" does have a legitimate use when we want to emphasize that we are talking about the parameter of some universe or population from which we think our sample came. We do not estimate any statistics about our sample; those we compute or calculate. Estimation enters only when we infer from the statistics of our sample what is likely to be true of some population from which we think the sample came.

3. We put too much confidence in regression - perhaps because we say so glibly that they are unbiased. When we estimate  $Y$  from  $X$  and do it fairly, the estimate is unbiased from the standpoint of  $X$ , but it certainly is biased from the standpoint of  $Y$ . The  $Y$  we estimate for a given value of  $X$  is just as likely to be too low as it is to be too high. But if we ask whether we were fair with the  $Y$ 's which really had the higher values and with the  $Y$ 's which really had the lower value, the answer is an emphatic "no". We underestimate the high values of  $Y$  and we overestimate the low values of  $Y$ . This kind of reasoning occurs often when talking about whether the market pays the proper premiums for quality in meat. Let  $X$  be the appearance of the live animal when the buyer sees it, and let  $Y$  be the price which, on examination of the dressed carcass, we find the market should have paid. So long as the correlation between the two is less than perfect, it must inevitably happen that on the average too little was paid for the carcasses which turn out to be worth the least. The trouble is not at all in the wickedness of the buyer - or at least it may not be. (I would not vouch for the virtue of them all or that they never agree to divide the market, but I do think the competition between them is nearly always strong.) The trouble is more basic than that; it is the fact that the buyer simply has not the X-ray eye needed to see in the live animal exactly what will be visible when it is hanging on the hooks. In the language of the statistician, the buyer estimates their value with an unbiased regression equation! In the language of the poker player, when in doubt, he plays them close to his belt. Often a regression is the best we can do at the moment, with such information as we have. This should not make us infer that the regression is perfect. "Unbiased" has a peculiar and special meaning in this connection. Emphatically, it does not mean "perfect".

4. "Fitting constants" is much like solving simultaneous equations except that the equations we were taught in high school included no error term.  $X$  equalled something and  $Y$  equalled something, and the game was to find these things. In "fitting constants" we have a whole group of equations in  $X$  and  $Y$ , and each has its own unknown error term. We merely find what values of  $X$  and  $Y$  would make the sums of the squares of those error terms as small as any linear scheme possibly could. This is in

deriving the constants. When we apportion the variance, we are just doing what they did so widely with multiple correlation around the 1920's. The only new things are that the process of fitting may remove some of the curvilinearity and the scheme can derive numerical values for variables which are not intrinsically metrical, such as sires or months in the year, and that correction for degrees of freedom is more accurate than in the old multiple correlation method. Often we assume that the different elements in the "model" are uncorrelated - a mistake which the users of multiple correlation rarely make. Otherwise, the two processes are the very same. I think we would understand "fitting constants" more clearly and it would seem less mysterious if its similarity were explained to us when we first learned the method. Many an article contains some useful animal husbandry ideas that are buried so deep under statistical jargon that many who could use the ideas do not even suspect they are there!

5. How much may we be missing by relying on linear models, especially when we assume that the elements in the model are uncorrelated? I don't lose much sleep about the linearity (although perhaps I should), but I do worry considerably about assuming that the elements are uncorrelated. In many cases I know that some of the elements actually are correlated in the population I want to describe.

6. Many times we use regressions where correlations would show the closeness of the relationship more simply. In the teens and twenties, correlations were often overworked and abused in their causal interpretations. In the 1950's and the 1960's regressions are often overworked and abused in their causal interpretations! When a regression is coded into standard measure, it simply is a correlation. As devices for describing a sample, they are equally valid. When one infers from a sample to the population from which he thinks the sample came, he must use precautions in either case. Those precautions are not the same for the regression of  $X$  on  $Y$  as they are for the regression of  $Y$  on  $X$ . Those for the correlation naturally must be somewhat intermediate, since the correlation is simply the geometric average of these two regressions. In any event and for purely descriptive purposes, those precautions are made necessary only by the sample not being a truly random one or by the relations being curvilinear.

7. "Genetic load" is a frequent topic in current writings. It is loaded with semantic pitfalls. One way to avoid getting unduly excited about "genetic loads" is to describe in detail what a population with zero genetic load would be like. In such a population, the various kinds of genotypes would all reproduce at exactly the same rate; in other words, there would be no selection. "Genetic load" is synonymous with selection or competition. The selection may be ineffective (for various reasons) or it may be in a direction of which we do not approve, but if it exists, the population has a genetic load.

8. "Families" and "blood-lines" offer another semantic pitfall into which we often slip. They are attractive terms, and, having used them, we unconsciously convince ourselves that they exist! Instead of trying for a formal definition, perhaps we should ask: What makes them and what could preserve them once they are made? The Mendelian mechanism of inheritance

is continually making the population freshly heterogeneous in each generation, through forming groups of full-sibs, half-sibs, and other relationships. Then it is continually destroying these again in the next generation unless - as is rarely true - we keep the newly-formed groupings somewhat separate by some forming of linebreeding. Full-sibs are so rare in cattle that full-sib families scarcely count. Half-sibs have a quarter of their genic variance in common. That is, the genic standard deviation among the true means of half-sib families is about half as large as the genic standard deviation among individuals in that population. Half-sib families, or a "blood-line" which consists entirely of the offspring of one sire, do have enough distinctness that they can lay clear claim to being biological realities of some practical importance. But do you stop there? Sets of half-first-cousins (that is, each set would be the grandsons and granddaughters of one sire) are related about  $1/16$  and the genic standard deviation among their true means would be only about 0.25 as large as the genic standard deviation of individuals in that population. The genic standard deviation within such a set would be about 0.96 as large as the genic standard deviation of individuals. Isn't that getting nearly to the limit where "family" or "blood-line" would cease to have any real meaning? Do we have an intellectual hang-over from the days when, for want of any better techniques - and perhaps out of deference to the auctioneers - animal husbandmen spent many days studying "male lines" and "female lines"?

\* \* \* \*

C. E. Mees, Director of Eastman Kodak research for many years - quoted in American Scientist, Autumn 1962.

"Research is a gamble. It cannot be conducted according to the rules of efficiency engineering. Research must be lavish of ideas, money, and time.

The best advice is don't quit easily; don't trust anyone's judgment but your own, especially don't take any advice from any commercial person or financial expert; and, finally, if you really don't know what to do, match for it. The best person to decide what research shall be done is the man who is doing research. The next best is the head of the department. After that, you leave the field of best persons and meet increasingly worse groups.

The first of these is the research director, who is probably wrong more than half the time. Then comes a committee, which is wrong most of the time. Finally there is the committee of company vice-presidents, which is wrong all the time."



STATE REPORTS



AUBURN UNIVERSITY  
Agricultural Experiment Station

I. PROJECT: Animal Science 525 (S-10)

The Improvement of the Beef Cattle of Alabama Through Breeding Methods

II. OBJECTIVES:

To determine the effectiveness of mass selection for total performance in beef cattle.

To develop criteria for evaluating and selecting breeding animals.

To determine the influence of heterosis on rate of gain, carcass quality, and cow performance.

III. PERSONNEL:

T. B. Patterson, W. M. Warren, and G. B. Meadows

IV. ACCOMPLISHMENTS DURING THE YEAR:

1. Scope and nature of work

No additional facilities, other than fencing and the establishment of new pasture areas, were added during the past year.

A total of 265 brood cows, 31 replacement heifers, and 14 herd bulls are currently in use on various phases of the project.

2. Research results

Data collected in the purebred selection lines are presently being prepared for analysis. Heritability estimates and repeatability for each measured trait will be used to calculate "most probable producing ability" for each dam. This measurement will be used to divide the herds for future studies. In addition, a selection index will be developed for use in any future work. Sufficient data are now available to calculate correction factors for age of dam and sex of calf with reasonable accuracy.

Due to limited facilities, reproduction, and production, the Shorthorn cattle have been eliminated from the purebred selection phase.

Limited data are presently available for the second phase of the crossbreeding study. Data from 27 two-way and 44 three-way cross steers show an advantage at weaning of 23 pounds in favor of the three-way cross

steers. However, no differences were noted in postweaning performance. Smaller differences were obtained in heifers than in steers. The difference at weaning between 27 two-way cross and 31 three-way cross heifers was only 6 pounds. The three-way cross heifers gained 0.04 pounds per day faster on postweaning test than did the two-way cross heifers.

A postweaning performance test was completed on 107 bulls and 81 heifers. The average daily gain and weight-per-day-of-age for the test bulls were lower than in previous years. Pneumonia at the start of the test period plus unusual fluctuation in temperature probably accounted for most of the lowered performance.

V. FUTURE PLANS:

The project will be revised. The second phase of the crossbreeding will be retained and carried to completion.

VI. PUBLICATIONS DURING THE YEAR:

Final report for the bull performance test.

VII. PUBLICATIONS PLANNED:

None

Submitted by: T. B. Patterson

I. PROJECT: Animal Science 525-1 (S-10)

A Comparison of Crossbreeding and Within Breed Selection on Beef Cattle Production in the Black Belt Area of Alabama

II. OBJECTIVES:

To evaluate the significance of hybrid vigor in various crosses of beef cattle with regard to production of slaughter calves, stocker or feeder steers, and slaughter steers.

To determine the effect of heterosis on mothering ability, adaptability, and fertility.

To determine the most economical method of finishing steer calves that are dropped in the spring from the above system.

III. PERSONNEL:

Troy B. Patterson, L. A. Smith, and Harold Grimes

IV. ACCOMPLISHMENTS DURING THE YEAR:

1. Scope and nature of work

Seventy-five brood cows (25 Hereford, 24 Angus-Hereford, and 27 three-fourths Hereford-one-fourth Brahman) are devoted to this study. Data collected include weaning weights and breeder and slaughter grades on all calves, and postweaning growth and carcass information on all steer calves.

2. Research results

The results obtained from previous crossbreeding studies along with data collected for the first phase of the current study have been analyzed and are in the process of being prepared for publication. These data indicate a significant difference between breed crosses ( $P < 0.01$ ) for weaning weight. In all studies this difference favors the crossbred calf. Later work shows that the crossbred cows wean a higher percent calf crop and remain in production longer than do straight-bred Hereford controls. Year differences and season of birth of calves were both highly significant.

Data from the final phase of the current study continue to substantiate previous results from the same station. Average daily gain, conformation score, and percent calf crop weaned are given in table 1.

Table 1. Crossbreeding Results - 4 Year Average,  
Black Belt Substation

Breed of Calf	No. of Calves	Adjusted		Percent Calf Crop
		A, D.G. Weaning	Conf. Score	
Hereford	55	1.56	11.5	72.4
3/4 H - 1/4 A	33	1.82	11.8	89.2
3/4 A - 1/4 H	32	1.72	11.9	82.1
7/8 H - 1/8 B	58	1.70	11.1	76.3

The crossbred calves continue to grow at a significantly higher rate in the feedlot than do the Hereford controls. No significant differences in carcass measurements have been observed.

V. FUTURE PLANS:

The project will be continued on the present basis.

VI. PUBLICATIONS DURING THE YEAR:

None

VII. PUBLICATIONS PLANNED:

An Experiment Station Bulletin entitled Crossbreeding Beef Cattle in the Black Belt Area of Alabama is being prepared.

Submitted by: T. B. Patterson

I. PROJECT: 525-2 (S-10)

The effects of Breed and Breed Crosses on Milk Production and on Other Production Factors in a Grade Beef Herd.

II. OBJECTIVES:

To determine the effect of Brown Swiss, Holstein, and Charolais breeding on (a) milk production, (b) weaning weights and grades, (c) feed lot performance, and (d) carcass desirability.

To evaluate methods of increasing milk production in a grade beef herd through use of selected bulls from different breeds.

III. PERSONNEL:

Troy B. Patterson, W. W. Cotney, and R. A. Moore

IV. ACCOMPLISHMENTS DURING THE YEAR:

1. Scope and nature of work

Seventy-five grade Hereford cows were divided into similar groups of 25 each on the basis of age, breeding, and previous production record. They were bred to Hereford (control), Brown Swiss, and Charolais bulls. The bulls will be changed each year and the cows redivided to minimize sampling differences. In addition, grade Holstein cows will be bred to the Hereford bull that is used as a control.

The females thus produced will serve as foundation stock for the project. The foundation females will be backcrossed to Hereford bulls selected from known high milk dams. Milk production, weaning weights, and grades will be determined for each generation (three generations of backcrosses). In addition, postweaning performance and carcass information will be obtained.

2. Research results

Calves by the first set of bulls were weaned during the year and the steer calves finished in the feedlot and slaughtered. The Brown Swiss bull was sterile; therefore, his group of cows was bred to the Hereford bull during the latter part of the breeding season. Corrected weaning weights for the three groups of calves are: Hereford - 452 pounds, Charolais - 495 pounds, and late born Hereford - 528 pounds. The difference in the weaning weight of the two groups of Hereford calves of 76 pounds may be attributed to season of calving (fall vs. winter). The difference of 43 pounds in favor of the Charolais-cross calves would be due in part to heterosis. The Charolais calves gained

40 pounds more on late summer pasture than did the Hereford calves. This summer gain was based on actual weaning weight as the initial weight, rather than on adjusted weight. The Hereford calves gained faster in the feed lot, 2.68 pounds per day compared to 2.57 pounds per day for the Charolais in a 158-day feeding period. Average final shrunk weights for the two groups are: (1) Hereford - 971 pounds, (2) Charolais-cross - 1042 pounds. Carcass data are incomplete at the present time. However, the Charolais cross calves graded 10.6, had only 0.2 inches of outside fat at the rib, and had 2.42 square inches of ribeye per cwt. carcass. The Hereford calves graded 11.2, had 0.32 inches of outside fat, and had 2.07 square inches of ribeye per cwt. carcass.

The second group of calves, including some Hereford-Holstein crosses, is now on the ground.

V. FUTURE PLANS:

The project will be continued on present basis.

VI. PUBLICATIONS DURING THE YEAR:

None

VII. PUBLICATIONS PLANNED:

None

Submitted by: T. B. Patterson

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Alabama

Location	Auburn	Auburn	Auburn	Auburn	Auburn
Breed of sire	Angus	Hereford	Shorthorn	Angus	Angus
Breed of dam	Angus	Hereford	Shorthorn	Hereford	Shorthorn
Line or group	Purebred	Purebred	Purebred	Cross-breeding	Cross-breeding
Percent used in project	100	100	100	100	100
Inventory as of July 1, 1965					
Cows 2 years and over	72	57	0	10	10
Yearling heifers	17	14	0	0	0
Bulls and steers under 1 year	22	29	0	2	1
Heifers under 1 year	22	20	2	5	4
Bulls over 1 year	9	13	0	0	0
Steers over 1 year	7	1	1	0	0
Percent pregnant <sup>1</sup>	87.8	72.9	42.9	66.7	83.3
Calf survival percent <sup>2</sup>	89.2	95.3	83.3	100.0	80.0
Repro. perf.					
Adj. ADG <sup>3</sup>	1.60	1.52	1.49	1.34	1.58
Wean. perf.					
Av. type sc.	12.2	12.2	11.8	11.0	11.3
Postweaning performance perf.					
No. of bulls	20	21	0	0	0
No. of heifers	29	16	9	3	1
Slaughtered performance					
No. of steers	7	1	1	1	3
No. of bulls	3	2	0	0	0
No. of heifers	0	0	0	0	0
No. of steers	0	0	0	1	3

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

Mature dam, steer equivalent.

## FORM I

## PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Alabama

Location	Auburn	Auburn	Auburn	Auburn	Auburn
Breed of sire	Angus	Hereford	Hereford	Shorthorn	Shorthorn
Breed of dam	Shorthorn x Hereford	Angus x Shorthorn	Shorthorn x Angus	Angus x Hereford	Hereford x Angus
Line or group	Cross- breeding	Cross- breeding	Cross- breeding	Cross- breeding	Cross- breeding
Percent used in project	100	100	100	100	100
Inventory as of July 1, 1965	Cows 2 years and over	12	11	12	12
	Yearling heifers	0	0	0	0
	Bulls and steers under 1 year	5	5	3	4
	Heifers under 1 year	3	1	4	1
	Bulls over 1 year	0	0	0	0
	Steers over 1 year	0	0	0	0
Repro. perf.	Percent pregnant <sup>1</sup>	100.0	75.0	100.0	75.0
	Calf survival percent <sup>2</sup>	100.0	100.0	100.0	100.0
Wean. perf.	Adj. ADG <sup>3</sup>	1.69	1.61	1.67	1.60
	Av. type sc.	12.4	12.8	13.0	12.0
Postweaning perf.	No. of bulls	0	0	0	0
	No. of heifers	3	3	2	2
	No. of steers	5	3	5	2
Slaughtered perf.	No. of bulls	0	0	0	0
	No. of heifers	0	0	0	0
	No. of steers	5	3	5	2

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

Mature dam, steer equivalent

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State      Alabama

Location	Auburn	Auburn	Auburn	Auburn	Auburn
Breed of sire	Hereford	Hereford	Shorthorn	Shorthorn	Angus
Breed of dam	Angus	Shorthorn	Angus	Hereford	Hereford x Shorthorn
Line or group	Cross-breeding	Cross-breeding	Cross-breeding	Cross-breeding	Cross-breeding
Percent used in project	100	100	100	100	100
Inventory as of July 1, 1965	Cows 2 years and over	10	10	10	12
	Yearling heifers	0	0	0	0
	Bulls and steers under 1 year	1	0	3	5
	Heifers under 1 year	6	1	2	3
	Bulls over 1 year	0	0	0	0
	Steers over 1 year	0	0	0	0
	Percent pregnant <sup>1</sup>	100.0	100.0	28.6	33.3
	Calf survival percent <sup>2</sup>	66.7	100.0	100.0	100.0
Repro. perf.	Adj. ADG <sup>3</sup>	1.57	1.65	1.59	1.44
	Av. type sc. <sup>4</sup>	12.8	12.6	12.5	10.5
	No. of bulls	0	0	0	0
	No. of heifers	3	3	0	2
Postweaning performance	No. of steers	1	4	2	4
	No. of bulls	0	0	0	0
	No. of heifers	0	0	0	0
	No. of steers	1	4	2	4
Slaughtered performance					

1 - Use palpation percent or percent of cows that gave birth to calves (dead and alive). If palpation record is used, do not include those pregnant cows that were disposed of before calving.

2 - Percent of calves born (dead and alive) that survived to weaning. The product of percent pregnant and survival percent gives weaning percent.

3 - Indicate adjustments:

Mature dam, steer equivalent

4 - Suggest S-10 scoring system; indicate if different.

## FORM I

## PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Alabama

Location	Black Belt Substation	Black Belt Substation	Black Belt Substation	Black Belt Substation	
Breed of sire	Hereford	Hereford	Hereford	Angus	
Breed of dam	Hereford	3/4 H.- 1/4 Brah.	1/2 A. 1/2 H.	1/2 A. 1/2 H.	
Line or group	Cross-breeding	Cross-breeding	Cross-breeding	Cross-breeding	
Percent used in project	100	100	100	100	
Inventory as of July 1, 1965	Cows 2 years and over	20	28	13	13
	Yearling heifers	0	0	0	0
	Bulls and steers under 1 year	11	13	4	6
	Heifers under 1 year	9	11	8	7
	Bulls over 1 year	2	0	0	1
	Steers over 1 year	0	0	0	0
	Percent pregnant <sup>1</sup>	90	100	100	92.6
	Calf survival percent <sup>2</sup>	90	100	100	78.6
Repro. perf.	Adj. ADG. <sup>3</sup>	1.46	1.69	1.88	1.71
	Av. type sc.	12.3	11.50	12.8	12.0
Postweaning performance perf.	No. of bulls	0	0	0	0
	No. of heifers	0	0	0	0
	No. of steers	10	10	4	3
	No. of bulls	0	0	0	0
Slaughtered	No. of heifers	0	0	0	0
	No. of steers	10	10	4	3

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

Mature dam, steer equivalent.

- a. As constituted presently.
- b. Last years calf crop by breeding groups.

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Alabama

Location	Winfield	Winfield	Winfield		
Breed of sire	Hereford	Charolais	Brown		
Breed of dam	Grade	Grade	Swiss		
Line or group	Hereford	Hereford	Grade		
Percent used in project	Cross- breeding	Cross- breeding	Hereford		
Inventory as of July 1, 1965	100	100	100		
Cows 2 years and over	23	22	26		
Yearling heifers	15	9	0		
Bulls and steers under 1 year	14	9	14		
Heifers under 1 year	9	10	12		
Bulls over 1 year	1	1	1		
Steers over 1 year	0	0	0		
Repro. perf.	Percent pregnant <sup>1</sup>	82.8	88.9	-	
Wean. perf.	Calf survival percent <sup>2</sup>	95.8	95.8	-	
Weaning perf.	Adj. ADG <sup>3</sup>	1.54	1.66	-	
Postweaning performance	Av. type sc.	11.5	10.0	-	
Slaughtered performance	No. of bulls	0	0	-	
	No. of heifers	15	9	-	
	No. of steers	14	14	-	
	No. of bulls	0	0	-	
	No. of heifers	0	0	-	
	No. of steers	14	14	-	

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

Mature dam, steer equivalent

UNIVERSITY OF ARKANSAS  
Agricultural Experiment Station

I. PROJECT: Hatch 170 (S-10)

Evaluation of Performance Records of Beef Cattle

II. OBJECTIVES:

To continue to develop practical but adequate methods for identifying, evaluating, and propagating the genetic potential for the production of beef. This would involve determining the kind and number of performance records necessary to prove beef sires and dams, as well as the proper use of records in planning matings.

III. PERSONNEL:

C. J. Brown, M. C. Heck, R. S. Honea, and Frank Scaramuzza

IV. ACCOMPLISHMENTS DURING THE YEAR:

Improvement of facilities has continued with the clearing and seeding of about 100 acres of additional pasture land. Data were collected in accordance with the long range aspects of this project. The scope of the effort is indicated by the 492 young cattle that were weighed monthly and measured quarterly, 259 mature cattle that were measured semi-annually, and the 580 classifications for type by four judges. Ninety-six bulls were individually fed on a performance test. Carcass cut-out data were obtained on 45 of these bulls. In addition to the matings made to maintain the purebred herds, matings were made in two other experiment station herds which would permit the progeny testing of bulls with known performance records. Matings of 16 young bulls with known performance records have been made in these grade herds used in management studies.

In the companion state project which grew out of the work on this project the testing of bulls at central testing stations has continued. There were 135 bulls completing test in the spring and 140 bulls entered in the 1964 fall test at three locations.

The gains from five tests of 122 bulls that were slaughtered at the end of the test were studied by multiple regression techniques. The equations shown in table 1 indicate the relative association of feed consumption, initial weight, and indicators of carcass leanness with feedlot gains. A comparison of  $R^2$  values indicate that about 59 percent of the variance in gain was associated with feed consumption and initial weight. An additional 16 percent of the variance in gain was associated with round and loin weight, ribeye area, and fat thickness.

Correlations between feedlot performance and traits related to sexual development were calculated and are shown in table 2. On a constant weight

Table 1. Standard Partial Regression Coefficients (b) and Multiple Correlation Coefficients (R) of Variables Associated with Average Daily Gain of Performance Tested Beef Bulls

	Equation Number								
	1	2	3	4	5	6	7	8	9
Feed consumption	.690	.679	---	.478	.687	.681	.707	.703	.931
Initial weight	-.666	-.651	-.482	---	-.662	-.659	-.622	-.642	-.505
Ribeye area	-.053	-.076	-.146	-.186	---	-.073	.086	-.070	---
Fat thickness	.041	.044	.066	.139	.041	---	.075	.056	---
Round weight	---	-.499	.558	.428	.458	.506	---	.532	---
Loin weight	---	.078	.445	-.086	.068	.097	.323	---	---
Lean cuts	.523	---	---	---	---	---	---	---	---
$\bar{R}$	.848	.864	.733	.712	.863	.863	.820	.863	.766
$R^2$	.718	.747	.537	.507	.744	.746	.672	.745	.587
Reduction in $R^2$	---	---	.210	.240	.003	.001	.074	.002	.160

Table 2. Phenotypic Correlations Between Feedlot Performance and Traits Related to Sexual Development

Traits	ADG		Feed conversion	
	Intra-group	Partial <sup>a</sup>	Intra-group	Partial <sup>a</sup>
Hot carcass weight	.35*	----	-.30	----
Forequarter	.44**	.33*	-.36*	-.10
Hindquarter	.42**	.28	-.42**	-.42**
Carcass length	.44*	.31	-.35*	-.24
Loin eye area	.29	.25	-.51**	-.44**
Fat thickness	.16	.01	-.11	.03
Carcass grade	.33*	.17	-.26	-.16
Testes weight	-.11	-.28	.28	.44**
Rhomboideus weight	.37*	.18	-.14	-.55**
Neck circumference	.22	.08	-.10	-.10
Wholesale cuts:				
Chuck	.45**	.33*	-.37*	-.23
Rib	.39*	.20	-.40*	-.31
Round	.44**	-.28	-.58**	-.60**
Rump	.16	-.25	-.18	.24
Loin end	.44**	.30	-.37*	-.27
Short loin	.42**	.30	-.35*	-.20
Shoulder muscle areas:				
Rhomboideus	.37*	.18	-.19	.05
Spleniens	.33*	.19	-.26	-.13
Complexus	.41*	.29	-.36*	-.25
Spinalis dorsi	.26	.08	-.18	-.02
Intertransversales	.30	.09	-.11	-.01
Infraspinatus	.36	.20	-.47**	-.39*
Supraspinatus	-.06	-.27	.16	.15

<sup>a</sup>Hot carcass weight constant

\* (P<.05)

\*\* (P<.01)

basis forequarter and chuck were significantly related to gain ( $r = .33$ ,  $P < 0.05$ ). There is an indication that on a constant weight basis the bulls with heavier testicles were poorer converters of feed ( $r = .44$ ,  $P < 0.01$ ); whereas, the bulls with more lean tissue, as indicated by cut weights and muscle area, were better converters of feed. This would suggest that as the bull matures sexually and the endocrine function of the testicle increases it elicits two effects on feed conversion that are antagonistic.

Agonistic behavior and social rank within the pen were correlated with eight production traits and eight body measurements of performance tested bulls. This study involved 67 bulls in 469 paired contests. The 67 bulls included 40 Angus, 14 Hereford, and 13 Polled Hereford bulls. No breed difference in agonistic behavior were noted. Chest depth and heart girth were significantly correlated with agonistic behavior within a group. These pooled intra-group correlations were low being 0.27 and 0.28 ( $P < 0.05$ ) respectively, for chest depth and heart girth. Pooled intra-group correlations between observations early in the test period and those at the end of the test were 0.46 and 0.57 ( $P < 0.05$ ) for rank and aggressiveness, respectively.

#### V. FUTURE PLANS:

Work will continue along the lines of the project outline. Emphasis will be given to cow size relationships and early recognition of superior performance. See planned publications.

#### VI. PUBLICATIONS DURING THE YEAR:

Brown, C. J. and Larry Franks. 1964. Factors affecting size of young beef cows. *J. Animal Sci.* 23:665.

Brown, C. J. and Maximo Gacula. 1964. Estimates of heritability of beef cattle performance traits by regression of offspring on sire. *J. Animal Sci.* 23:321.

Brown, C. J., P. K. Lewis, Jr. and M. C. Heck. 1964. A study of differences in eating quality of steaks from beef bulls. *Ark. Farm Res.* 13(1):4.

Brown, C. J. and Carl Leuker. 1964. Performance of bulls on Arkansas cooperative beef bull performance test 2. *Ark. Agr. Expt. Sta. Report Series 129.*

Brown, C. J., R. S. Temple, C. B. Ramsey and P. K. Lewis, Jr. 1964. Ultrasonic and carcass measurements of young bulls. *J. Animal Sci.* 23:847. (Abs.)

VII. PUBLICATIONS PLANNED:

Publication on relationship of cow size to production.

Publication on relationship of size to feedlot performance of bulls.

Publication on relationship of carcass composition to performance of bulls.

Submitted by: C. J. Brown

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

			State	Arkansas	
Location	Main Station	Main Station	Main Station	Main Station	
Breed of sire	Angus	Angus	Hereford	Hereford	
Breed of dam	Angus	Angus	Hereford	Hereford	
Line or group	Purebred	Purebred	Purebred	Purebred	
Percent used in project	100	100	100	100	
Inventory as of July 1, 1965					
Cows 2 years and over	176		124		
Yearling heifers	47		31		
Bulls and steers under 1 year	73		47		
Heifers under 1 year	59		45		
Bulls over 1 year	51		32		
Steers over 1 year	0		0		
Repro. perf.	Percent pregnant <sup>1</sup>	Spring 73	Fall 88	Spring 82	Fall 84
Wean. perf.	Calf survival percent <sup>2</sup>	90	89	85	95
Postweaning perf.	Adj. ADG <sup>3</sup>	1.76	1.54	1.74	1.42
Slaughtered	Av. type sc.	11.4	12.8	11.4	12.2
	No. of bulls	26	25	21	22
	No. of heifers	26	24	12	17
	No. of steers	0	0	0	0
	No. of bulls	22	14	13	9
	No. of heifers	0	0	0	0
	No. of steers	0	2	0	1

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

Sex, age of dam, and season of birth.

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Arkansas

Location	Fayette-ville	Fayette-ville	Fayette-ville	Fayette-ville	Fayette-ville
Breed of sire	Angus	Hereford	Charolais	Red Poll	Shorthorn
Breed of dam	Angus	Hereford	Charolais	Red Poll	Shorthorn
Line or group	Purebred	Purebred	Purebred	Purebred	Purebred
Percent used in project	100	100	100	100	100
Inventory as of July 1, 1965	Cows 2 years and over				
	Yearling heifers				
	Bulls and steers under 1 year				
	Heifers under 1 year				
	Bulls over 1 year				
	Steers over 1 year				
Repro. perf.	Percent pregnant <sup>1</sup>				
	Calf survival percent <sup>2</sup>				
Wean. perf.	Adj. ADG <sup>3</sup>				
	Av. type sc.				
Postweaning performance	a No. of bulls	12	23	1	2
	No. of heifers				
	No. of steers				
Slaughtered	No. of bulls				
	No. of heifers				
	No. of steers				

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

<sup>a</sup>These bulls were individually fed on State Project 565 for cooperating breeders.

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Arkansas

Location	Hope	Hope	Hope	Hope	
Breed of sire	Angus	Hereford	Santa Gertrudis	Shorthorn	
Breed of dam	Angus	Hereford	Santa Gertrudis	Shorthorn	
Line or group	Purebred	Purebred	Purebred	Purebred	
Percent used in project	100	100	100	100	
Inventory as of July 1, 1965	Cows 2 years and over				
	Yearling heifers				
	Bulls and steers under 1 year				
	Heifers under 1 year				
	Bulls over 1 year				
	Steers over 1 year				
Repro. perf.	Percent pregnant <sup>1</sup>				
	Calf survival percent <sup>2</sup>				
Wean. perf.	Adj. ADG <sup>3</sup>				
Postweaning performance perf.	Av. type sc. a				
	No. of bulls	9	14	10	7
	No. of heifers				
	No. of steers				
Slaughtered	No. of bulls				
	No. of heifers				
	No. of steers				

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

<sup>a</sup>These bulls were individually fed on State Project 565 for cooperating breeders.

## FORM I

## PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Arkansas

Location	Newport	Newport	Newport	Newport	
Breed of sire	Angus	Hereford	Santa Gertrudis	Charolais	
Breed of dam	Angus	Hereford	Santa Gertrudis	Charolais	
Line or group <sup>1</sup>	Purebred	Purebred	Purebred	Purebred	
Percent used in project	100	100	100	100	
Inventory as of July 1, 1965	Cows 2 years and over				
	Yearling heifers				
	Bulls and steers under 1 year				
	Heifers under 1 year				
	Bulls over 1 year				
	Steers over 1 year				
Repro. perf.	Percent pregnant <sup>1</sup>				
	Calf survival percent <sup>2</sup>				
Wean. perf.	Adj. ADG <sup>3</sup>				
	Av. type sc.				
Postweaning performance	a				
	No. of bulls	38	16	3	3
	No. of heifers				
Slaughtered	No. of steers				
	No. of bulls				
	No. of heifers				
	No. of steers				

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

These bulls were individually fed on State Project 565 for cooperating breeders.

UNIVERSITY OF FLORIDA  
Agricultural Experiment Station

I. PROJECT: 1136 (S-10)

Biochemical and Cytological Investigations of Inherited Dwarfism in Beef Cattle

II. OBJECTIVES:

To determine biochemical abnormalities in body fluids and tissues which may serve to identify carriers of the dwarfism trait.

To determine the cytogenetic characteristics of dwarf, carrier, and non-carrier cattle.

III. PERSONNEL:

J. R. Crockett, F. C. Neal, and M. Koger

IV. ACCOMPLISHMENTS DURING THE YEAR:

Embryology of the dwarf and normal is still being made in order to bracket the age that the abnormality first shows itself. Electrophoretic studies are being made on the various body fluids. At present, cytological studies have not shown any indication of the abnormality.

V. FUTURE PLANS:

Experimental results in embryology are rapidly becoming available and numbers are increasing so that interpretation may be made in the near future.

VI. PUBLICATIONS DURING THE YEAR:

None

VII. PUBLICATIONS PLANNED:

None

Submitted by: J. R. Crockett

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Florida

Location	Gainesville
Breed of sire	Hereford
Breed of dam	Variable
Line or group	Dwarf
Percent used in project	100
Inventory as of July 1, 1965	
Cows 2 years and over	29
Yearling heifers	3
Bulls and steers under 1 year	0
Heifers under 1 year	6
Bulls over 1 year	4
Steers over 1 year	0
Repro. perf.	
Percent pregnant <sup>1</sup>	
Calf survival percent <sup>2</sup>	
Wean. perf.	
Adj. ADG <sup>3</sup>	
Postweaning perf.	
Av. type sc.	
Slaughtered performance	
No. of bulls	
No. of heifers	
No. of steers	
Slaughtered	
No. of bulls	
No. of heifers	
No. of steers	

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

WEST CENTRAL FLORIDA EXPERIMENT STATION  
Brooksville, Florida

I. PROJECT: 629, AHRD dl-5 (S-10)

Selection of Cattle for Beef Production in Southeastern United States

II. OBJECTIVES:

To improve the reproductive efficiency and meat producing qualities of different strains of cattle under Florida conditions, to test various breeding systems with these cattle, and to determine if combining ability can be increased with cross-progeny testing.

III. PERSONNEL:

W. C. Burns, Marvin Koger, R. S. Temple, A. C. Warnick, A. Z. Palmer, J. R. Crockett, and H. L. Chapman.

IV. ACCOMPLISHMENTS DURING THE YEAR:

1. Scope and nature of work

Permanent improvements and installations include preparing 130 acres of raw land for planting to permanent pastures; 60 acres completely renovated and planted; and the installation of a feed mill that blends chopped hay, molasses, and concentrate together.

2. Research results

Injectible Vitamin A had no effect on weight gains of yearling heifers. The control group gained 203 pounds and the treated group gained 197 pounds during the year.

Injectible Vitamin A had some response on two-year-old heifers. The treated group gained 227 pounds and had a pregnancy rate of 82 percent. The control group gained 218 pounds and had a 72 percent pregnancy rate.

Injectible Vitamin A had no beneficial effects on the performance of the cow herd. The treated group gained 24 pounds and had an 80 percent conception rate; whereas, the control group gained 30 pounds and had an 88 percent conception rate.

The Brooksville Herefords, Line 6, had the highest conception rate, 91 percent; followed by Santa Gertrudis, 89 percent; Angus, 88 percent; F<sub>1</sub> Brahman x Angus crossbreds, 87 percent; and the Brahmans were lowest with a 53 percent conception rate.

The Santa Gertrudis cattle continued to wean the heaviest calves, 523 pounds; followed by the 3/4 Angus-1/4 Brahman calves, 461 pounds; Line 6 Hereford, 440 pounds; Angus, 436 pounds; and Brahman, 409 pounds.

There was a definite sire x breed of cow interaction in the "Combining Ability" study. One Angus bull sired better crossbred calves than he did Angus calves and another bull sired better straight Angus calves than he did crossbred calves. The other four Angus bulls sired calves of equal merit from each type of cow. Sons of the two interaction bulls are being used this year.

V. FUTURE PLANS:

The Vitamin A work on mature cattle and the "Combining Ability" study will be continued.

VI. PUBLICATIONS DURING THE YEAR:

Burns, W. C. and M. Koger. 1963. Response of different breed groups to creep feeding. *J. Animal Sci.* 22:244. (Abs).

Cobb, Estel H., W. C. Burns and M. Koger. 1964. Comparative performance of British, Brahman and crossbred foundation cattle. *J. Animal Sci.* 23:848. (Abs).

Kirst, Robert C. 1964. Factors influencing pregnancy rate of beef cows at West Central Florida Experiment Station. Master's Thesis. University of Florida, Gainesville, Florida.

VII. PUBLICATIONS PLANNED:

1. The comparison of protein and hay on the performance of mature beef cows in a summer program.

Submitted by: W. C. Burns

I. PROJECT: 1186, AHRD dl-41 (S-10)

A Study of Response to Selection and Genetic-Environmental Interaction in Genetically Similar Groups of Hereford Cattle at Two Locations (Miles City, Montana and Brooksville, Florida).

II. OBJECTIVES:

To determine whether originally genetically similar groups of cattle, bred and selected for several generations according to the same criteria in the two markedly different environmental conditions of Miles City, Montana and Brooksville, Florida, become genetically different or remain similar.

To estimate the importance of genetic-environmental interaction within a British breed of beef cattle.

To determine the importance of adaptation to a specific location, if maximum productivity is to be attained.

III. PERSONNEL:

E. J. Warwick, O. F. Pahnish, W. C. Burns, J. S. ~~Wright~~, R. A. ~~Wright~~, Marvin Koger, and F. S. Willson

IV. ACCOMPLISIMENTS DURING THE YEAR:

A third calf crop has been weaned. A photographic grid was constructed for taking measurements. Performance of the cattle were as shown in table 1.

Table 1. Performance of Genetic-Environmental Interaction Cattle, 1964 1965

Line	No.	Age days	Slaughter grade	Feeder grade	Weaning weight	Adj. daily gain
5	8	201	9.1	10.6	373	1.69
4	33	213	9.3	11.0	391	1.67
6	22	213	10.9	12.4	440	1.81

Blood and liver analyses were made during the past year. The results of these analyses are shown in tables 2 and 3.

TABLE 2. Blood Analysis at Brooksville, Genetic-Environmental Interaction Project

	Hb	PCV	P	Cu	Ca
11/26/63					
at WCF					
Brooksville cows	10.5	38.9	5.60	0.86	10.8
MC cows	11.2	41.3	5.68	0.83	10.8
Calves from MC	9.0	38.0	5.85	1.07	10.0
Cull cows	9.7	41.4	5.71	0.95	10.3
4/29/64					
Brooksville cows	12.7	38.8	5.03	0.78	10.9
MC cows	13.1	39.9	5.02	0.86	10.7
MC calves	13.1	35.8	5.65	0.71	11.3
9/17/64					
Brooksville cows	12.8	42.8	5.02	0.69	10.9
MC cows	11.1	41.8	5.10	0.70	10.7
Brooksville yearlings	11.6	38.4	5.45	0.77	10.8
MC yearlings	11.6	38.8	5.56	0.85	10.9
11/24/64					
Brooksville cows	10.9	40.9	5.34	0.78	10.3
MC cows	10.3	44.5	5.32	0.82	10.5

TABLE 3. Liver Analysis at Brooksville, Genetic-Environmental Interaction Project

	Cu(ppm)	Fe(ppm)
4/29/64		
Brooksville cows	181.5	213.8
MC cows	73.1	253.0
MC calves	253.7	188.2
9/17/64		
Brooksville cows	219.5	258.5
MC cows	160.9	339.6
MC yearlings	147.0	290.4
2-year olds	269.6	298.2

V. FUTURE PLANS:

The blood and liver work and other aspects of the project will be continued as planned.

VI. PUBLICATIONS DURING THE YEAR:

None

VII. PUBLICATIONS PLANNED:

None

Submitted by: W. C. Burns

I. PROJECT: 1245 (S-10)

Three-month versus twelve-month breeding seasons for beef cattle.

II. OBJECTIVES:

To compare the reproductive and weaning performance of Brahman and Santa Gertrudis cows bred during a three-month breeding season as opposed to a continuous twelve-month breeding season.

III. PERSONNEL:

A. C. Warnick, M. Koger, W. C. Burns, R. S. Temple, and E. J. Warwick

IV. ACCOMPLISHMENTS DURING THE YEAR:

The cattle have been sorted into the respective breeding herds as a part of the initial stage of this project. Routine monthly palpation is being done on all yearlings and older cattle.

V. FUTURE PLANS:

The project will be continued as planned. Numbers will be increased to 60 in each breed.

VI. PUBLICATIONS DURING THE YEAR:

None

VII. PUBLICATIONS PLANNED:

None

Submitted by: W. C. Burns

FORM I

PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Florida

Location	Brooksville	Brooksville	Brooksville	Brooksville	Brooksville
Breed of sire	Angus	Brahman	Hereford	Hereford	Hereford
Breed of dam	Angus	Brahman	Hereford	Hereford	Hereford
Line or group	Combining ability	Repro. study	Brooksville GEI	M. C. closed GEI	M. C. control GEI
Percent used in project	100	100	100	100	100
Inventory as of July 1, 1965	Cows 2 years and over	94	47	42	77
	Yearling heifers	25	3	10	18
	Bulls and steers under 1 year	35	11	14	15
	Heifers under 1 year	29	10	15	10
	Bulls over 1 year	32	9	2	15
	Steers over 1 year	-	-	-	-
	Percent pregnant <sup>1</sup>	92.4	54.5	93.0	85.0
Repro. perf.	Calf survival percent <sup>2</sup>	95.0	67.0	84.6	80.4
	Adj. ADG <sup>3</sup>	1.69	1.77	1.81	1.67
Postweaning performance	Av. type sc.	10.50	9.00	10.90	9.20
	No. of bulls	32	8	12	16
	No. of heifers	25	3	10	18
	No. of steers	-	-	-	-
	No. of bulls	6	-	2	2
Slaughtered performance	No. of heifers	-	-	-	-
	No. of steers	1	-	-	-

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

<sup>a</sup> This means that bulls from both the closed and control group were combined into one group.

## FORM I

## PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Florida

Location	Brooksville	Brooksville		
Breed of sire	Angus	Santa Gertrudis		
Breed of dam	1/2 B- 1/2 A	Santa Gertrudis		
Line or group	Combining ability	Repro. study		
Percent used in project	100	100		
Inventory as of July 1, 1965	Cows 2 years and over Yearling heifers Bulls and steers under 1 year Heifers under 1 year Bulls over 1 year Steers over 1 year	89 - 27 50 - -	45 22 24 17 5 -	
Repro. perf.	Percent pregnant <sup>1</sup>	91.5	84.4	Adjustments: Bull .96
	Calf survival percent <sup>2</sup>	92.0	86.3	Steer 1.00 Heifer 1.08
Wean. perf.	Adj. ADG <sup>3</sup>	1.94	2.19	II. Dam factor
Postweaning performance	Av. type sc.	11.24	10.40	Age 01 1.23 Age 02 1.16 Age 03 1.10 Age 04 1.05 Age 05 1.03 Age 06-10 1.00 Age 11 1.05
Slaughtered	No. of bulls	-	6	
	No. of heifers	41	22	
	No. of steers	29	5	
	No. of bulls	-	2	
	No. of heifers	41	-	
	No. of steers	29	5	

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

GEORGIA COASTAL PLAIN EXPERIMENT STATION  
Tifton, Georgia

I. PROJECT: Animal Husbandry 209, AHRD dl-3 (S-10)

A Study of Grading, Crisscrossing and Rotational Crossing as Breeding Systems for Commercial Beef Production.

II. OBJECTIVES:

To study the relative value of grading, crisscrossing, and rotational crossing as breeding systems for commercial beef production.

To study heterotic effects in crosses between Angus and Polled Hereford breeds, as compared to heterosis in crosses between these breeds and Santa Gertrudis - a breed based partially on a Brahman foundation.

To study the comparative value of the Santa Gertrudis breed with the Angus and Polled Hereford breeds.

III. PERSONNEL:

W. C. McCormick, T. M. Clyburn, R. L. Saffle, and B. L. Southwell

IV. ACCOMPLISHMENTS DURING THE YEAR:

The foundation cows raised their last crop of calves in 1964. Weaning data for these calves were as shown in table 1.

TABLE 1. Weaning Data, 1964 Calves, Foundation Cows

Herd	Breeding system	No. calves	Av. birth weight	A.D.G. birth to weaning	Av. type score	Av. condition score
Gr. A	Grading-up	15	58.3	1.45	11.1	10.1
Gr. PH	Grading-up	13	65.6	1.33	9.9	8.6
Gr. SG	Grading-up	10	79.5	1.98	9.7	9.6
AxPH	Crisscrossing	12	64.2	1.52	10.7	9.3
AxSG	Crisscrossing	16	61.4	1.61	10.6	10.6
PHxSG	Crisscrossing	8	71.5	1.51	10.6	10.3
AxPHxSG	Rotational crossing	21	67.0	1.66	10.5	10.3

Reproductive data for the foundation cows during the eight years of calving were as shown in table 2.

TABLE 2. Reproduction Data, Foundation Cows, 1958-1965

Breeding group	Number exposed	Number born	Percent calf crop born	Number still-born			Number weaned	Percent still-born	Percent died	Percent calf crop weaned
				Number still-born	Number died	Number weaned				
Gr. A	214	191 <sup>b</sup>	89.3	7	3	181	3.66	1.57	84.6	
Gr. H	216	189 <sup>a</sup>	87.5	3	4	182	1.39	2.12	84.3	
Gr. SG	196	177	90.3	7	6	164	3.95	3.39	83.7	
AxH	209	192	91.9	4	5	183	2.08	2.60	87.6	
AxSG	182	161 <sup>b</sup>	88.5	7	3	151	4.35	1.86	83.0	
HxSG	200	182 <sup>b</sup>	91.0	2	3	177	1.10	1.65	88.5	
AxHxSG	302	275 <sup>c</sup>	91.1	5	2	268	1.82	0.73	88.7	
	1519	1367	90.0	35	26	1306	2.56	1.90	86.0	
Grades	626	557	89.0	17	13	527	3.05	2.33	84.2	
Crossbreds	893	810	90.7	18	13	779	2.22	1.60	87.2	

<sup>a</sup>one, <sup>b</sup>two, <sup>c</sup>three pairs of twins.

Weaning data for the 1964 calf crop raised by generation-one animals are shown in table 3.

TABLE 3. Weaning Data, 1964 Calves, Generation-one Females

Herd	Breeding system	Number calves	Average	A.D.G.	Average	Average
			birth weight	birth to weaning		
Gr. A	Grading-up	21	55.4	1.30	10.0	8.3
Gr. PH	Grading-up	28	62.5	1.22	10.4	8.7
Gr. SG	Grading-up	21	66.5	1.89	9.3	8.9
AxPH	Crisscrossing	26	60.5	1.37	10.1	8.7
AxSG	Crisscrossing	24	63.0	1.70	9.7	8.8
PHxSG	Crisscrossing	26	65.6	1.74	10.0	9.3
AxPHxSG	Rotational crossing	29	67.9	1.73	10.3	9.4

Generation-two females are being selected to replace generation-one animals, and a few generation-two females were bred first in 1964 to calve in 1965.

#### V. FUTURE PLANS:

The studies will be continued as planned.

VI. PUBLICATIONS DURING THE YEAR:

Routine annual reports.

VII. PUBLICATIONS PLANNED:

First six years' weaning data for generation-one animals have been written as a journal paper and are being submitted for publication. The three years' data on growth and carcass studies have also been submitted for publication.

Submitted by: W. C. McCormick

I. PROJECT: Animal Husbandry 224, AHRD dl-3 (S-10)

Improvement of Performance and Carcass Quality in Beef Cattle Through Selection

II. OBJECTIVES:

To develop herds of Polled Hereford and Angus cattle with superior performance.

To progeny test Polled Hereford and Angus sires with selection criteria based primarily on pre- and postweaning growth rate, and carcass meatiness and tenderness.

III. PERSONNEL:

W. C. McCormick, R. L. Saffle, and B. L. Southwell

IV. ACCOMPLISHMENTS DURING THE YEAR:

The Polled Hereford herd of around 105 females was mated to five sires. Progeny-tested sires 47, 853, and 111B were bred to cows designated as superior and to tester cows. Performance-tested bulls 238 and 152 were mated to tester cows. The Angus cows were bred artificially to 4636, an American Breeders Service sire, and to J339, a sire owned jointly with Kermac Ranch.

The calves were born January to March, and all bull calves were creep-fed. All calves were weaned September 15, 1964, and the bulls were placed on feed immediately for 168 days. Both the Angus and Polled Hereford bulls were fed by sire groups. At weaning, prospective breeding heifers were separated and placed on pasture. Restricted grain feeding was practiced until small grain pasture was ready to graze. Thereafter, grain feeding was discontinued. Growth and feedlot data are shown in table 1. At the end of the feeding period, calves sired by 152 and 238 were slaughtered to obtain carcass data as shown in table 2.

TABLE 1. Growth and Feedlot Data

Breed	Sire	No. bull calves	Weaned weight	Feedlot daily gain	Final age	Wt./day of age	Type score
PH	47	10	575	2.69	402	2.55	12.1
PH	853	12	511	2.53	398	2.35	12.1
PH	111B	10	486	2.55	392	2.33	11.2
PH	152	7	482	2.72	402	2.33	12.1
PH	238	5	533	2.88	408	2.49	12.2
A	4636	9	470	2.63	395	2.33	12.2
A	J339	9	525	2.77	393	2.52	12.8

TABLE 2. Carcass Data

Breed	Sire	No. killed	Dressing percent	Avg. rib eye fat thickness	Average rib eye area/cwt. carcass	Carcass wt./day of age	Carcass length
PH	152	9	56.9	.40	2.29	1.13	43.6
PH	238	8	58.2	.46	2.27	1.24	43.6

V. FUTURE PLANS:

Continue project as outlined.

VI. PUBLICATIONS DURING THE YEAR:

Routine annual reports

VII. PUBLICATIONS PLANNED:

None

Submitted by: W. C. McCormick

I. PROJECT: State 2-99 (S-10)

Selection of Beef Cattle for Single Items of Importance in Profitable Beef Production

II. OBJECTIVES:

To obtain preliminary information on the relative effectiveness of selecting for a single character.

To observe trends in characters for which no selection is made when selection is for a single character.

III. PERSONNEL:

W. C. McCormick, T. M. Clyburn, and B. L. Southwell

IV. ACCOMPLISHMENTS DURING THE YEAR:

Four herds of Grade Polled Hereford females, owned and maintained by the Georgia State Prison Farm, Reidsville, are used to study selecting for (1) weaning weight, (2) rate of postweaning gain, (3) weaning score and, (4) average performance. For the latter group, replacements with records nearest average for each trait are selected. Bulls used in all four groups are selected from the Polled Hereford herd at Tifton. Weaning data for the 1964 calf crop are shown in tables 1 and 2.

TABLE 1. Weaning data, Foundation Cows, 1964 Calf Crop

Herd	No. calves weaned	Avg. birth weight	ADG-birth to weaning	Weaning scores	
				Type	Condition
"Average"	23	67.6	1.41	11.2	9.4
"Rate of gain"	28	73.4	1.42	11.0	9.4
"Score"	21	72.3	1.42	10.9	9.4
"Wean weight"	28	72.2	1.49	11.2	9.7

TABLE 2. Weaning data, Generation-1 Cows, 1964 Calf Crop

Herd	No. calves weaned	Avg. birth weight	ADG-birth to weaning	Weaning scores	
				Type	Condition
"Average"	29	64.7	1.17	10.4	8.6
"Rate of gain"	25	75.3	1.30	10.6	8.7
"Score"	29	64.3	1.30	10.9	9.2
"Wean weight"	27	67.1	1.25	10.5	8.8

Rate of gain during the postweaning wintering period (approximately October 15 to April 1) for heifer calves could not be determined at reporting time.

From the 1963 steer calf crop, animals were selected to obtain growth and carcass data. These steers were grazed from November 19, to August 31 of the following year on small grain and millet pastures. The results of this performance test are shown in table 3.

TABLE 3. Average Performance, by Herds, 1963 Steer Calves

Herd	A.D.G., lb.		Final	Final	Wt./	Slau.	Carcass	Sq. in.	rib	eye	Car-	Car.
	Pre-	Post-	wt.,	age,	day			per	per cwt.	Car-	wt./	
	weaning	weaning	lb.	days	of age	grade	wt.	length	carcass	grade	day	
"Wean wt."	1.50	1.87	981	600	1.62	9.0	573	48.0	1.58	9.1	.96	
"Rate of gain"	1.53	1.78	940	591	1.59	9.0	559	47.1	1.66	9.3	.94	
"Score"	1.58	1.67	904	581	1.56	9.3	531	47.2	1.61	8.6	.92	
"Average"	1.43	1.72	908	593	1.53	9.3	546	47.1	1.57	9.2	.92	

V. FUTURE PLANS:

The project will be continued as outlined. All foundation animals were retired in April, 1965, and generation-one replacements have been selected. Generation-two females are now being selected.

VI. PUBLICATIONS DURING THE YEAR:

Routine annual reports

VII. PUBLICATIONS PLANNED:

Weaning, growth, and carcass data will be analyzed as soon as the foundation animals wean the present crop of calves.

Submitted by: W. C. McCormick

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Georgia

Location	Tifton	Tifton	Reidsville	Reidsville	Reidsville
Breed of sire	Polled Hereford	Angus	Angus	Polled Hereford	Santa Gertrudis
Breed of dam	Polled Hereford	Angus	Grade Angus	Gr. Polled Hereford	Gr. Santa Gertrudis
Line or group	Purebred	Purebred	Grade	Grade	Grade
Percent used in project	80	80	100	100	100
Inventory as of July 1, 1965	Cows 2 years and over	85	39	37	44
	Yearling heifers	19	5	8	11
	Bulls and steers under 1 year	43	19	14	18
	Heifers under 1 year	39	20	10	20
	Bulls over 1 year	8	2	4 <sup>a</sup>	4 <sup>a</sup>
	Steers over 1 year	0	0	8	8
	Percent pregnant <sup>1</sup>	94	61	95	100
Repro. perf.	Calf survival percent <sup>2</sup>	94	100	95	95
	Adj. ADG <sup>3</sup>	1.73	1.76	1.36	1.20
	Av. type sc.	11.9	11.7	10.4	9.7
Postweaning performance	No. of bulls	44	18	0	0
	No. of heifers	43	11	0	0
	No. of steers	0	0	8	8
	No. of bulls	18	5	0	0
	No. of heifers	17	3	0	0
Slaughtered	No. of steers	0	0	0	0

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

<sup>a</sup>These twelve bulls used to breed all seven herds.

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Georgia

Location	Reidsville	Reidsville	Reidsville	Reidsville	Reidsville
Breed of sire	A, PH	A, SG	PH, SG	A, PH, SG	PH
Breed of dam	A x PH	A x SG	PH x SG	AxPHxSG	Gr. PH
Line or group	Crisscross	Crisscross	Crisscross	Crisscross	Wean wt.
Percent used in project	100	100	100	100	100
Inventory as of July 1, 1965	Cows 2 years and over	43	37	41	53
	Yearling heifers	12	8	10	10
	Bulls and steers under 1 year	17	12	14	23
	Heifers under 1 year	17	16	19	21
	Bulls over 1 year	a	a	a	2
	Steers over 1 year	8	8	8	12
					0
Repro. perf.	Percent pregnant <sup>1</sup>	100	103	97	100
	Calf survival percent <sup>2</sup>	100	93	97	100
Wean. perf.	Adj. ADG <sup>3</sup>	1.42	1.54	1.69	1.70
	Av. type sc.	10.2	9.3	10.1	10.4
Postweaning performance	No. of bulls	0	0	0	0
	No. of heifers	0	0	0	27
	No. of steers	8	8	8	12
	No. of bulls	0	0	0	0
	No. of heifers	0	0	0	0
Slaughtered performance	No. steers	0	0	0	12

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd for which pregnancy status was determined. (Wean.% = % pregnant x survival %).
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments.

<sup>a</sup>The twelve bulls used in Grade herds also used to breed these herds.

## FORM I

## PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Georgia

Location	Reidsville	Reidsville	Reidsville	
Breed of sire	Polled Hereford	Polled Hereford	Polled Hereford	
Breed of dam	Gr. Polled Hereford	Gr. Polled Hereford	Gr. Polled Hereford	
Line or group	Rate of Gain	Type	Average	
Percent used in project	100	100	100	
Inventory as of July 1, 1965	Cows 2 years and over	48	55	51
	Yearling heifers	15	19	20
	Bulls and steers under 1 year	29	23	21
	Heifers under 1 year	17	27	24
	Bulls over 1 year	2	2	2
	Steers over 1 year	0	0	0
	Percent pregnant <sup>1</sup>	96	91	95
	Calf survival percent <sup>2</sup>	94	92	94
Wean. perf.	Adj. ADG <sup>3</sup>	1.27	1.27	1.21
	Av. type sc.	10.0	10.2	10.1
	No. of bulls	0	0	0
	No. of heifers	25	25	27
Postweaning performance	No. of steers	0	0	0
	No. of bulls	0	0	0
	No. of heifers	0	0	0
	No. of steers	12	12	12
Slaughtered				

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

UNIVERSITY OF KENTUCKY  
Agricultural Experiment Station

I. PROJECT: Animal Science 260 (S-10)

Measurement and Selection of Economically Important Traits in Beef Cattle

II. OBJECTIVES:

To use rate of gain, efficiency of gain, conformation, and carcass characteristics in an over-all selection experiment.

To develop a method of estimating a bull's transmitting ability for carcass characteristics, as well as rate of gain and conformation.

III. PERSONNEL:

N. W. Bradley, D. G. Steele, W. P. Garrigus, and J. D. Kemp

IV. ACCOMPLISHMENTS DURING THE YEAR:

The herd of Hereford cattle being used by the University of Kentucky in the revised project has increased steadily over the past years to 477 head of varying ages and sexes. Of these, 349 are station-owned and 128 are cooperator-owned. During the first three months of 1965, 93 calves were born. At present 176 cows and heifers are being bred to calve during January, February, and March of 1966.

A postweaning performance test has been completed with 20 selected bulls from the 1963 calf crop. Three of these bulls were kept for progeny testing during the 1964-1965 breeding season. The other 17 bulls were slaughtered to obtain carcass measurements. A summary of the performance data is given in table 1, and a summary of the carcass measurements is given in table 2. The data are summarized according to the sire of the bulls. Progeny test data for these two sires (SP-194 and HP-RS-15) may be found in the 1963 annual report. Bulls sired by HP-RS-15 gained 0.18 pound per day faster and dressed 1.3 percent higher than the sons of SP-194. However, the progeny of SP-194 had 0.08 inches less fat over the rib-eye, 3.9 percent less fat in the 9-10-11th rib, and graded .5 yield grade units lower than those sired by HP-RS-15.

During the year, preweaning data were collected on 75 calves (table 3) and postweaning data were collected on 71 head of cattle (table 4). The large difference between sex in postweaning data are due partially to differences in management and feeding systems, and not entirely to sex.

Postweaning performance tests for cooperator's bulls were conducted at both Princeton and Quicksand stations. A total of 93 bulls were tested and sold to breeders throughout the state. Summaries of these tests according to breed are given in table 5.

TABLE 1. Preweaning and Postweaning Performance of Bulls by Two Different Sires

Item	Sire		
	SP 194	HP	RS 15
<u>Preweaning</u>			
Number	8		12
Age, Days	221		234
Weaning Wt., lb.	424		431
ADG, lb.	1.56		1.59
Adj. ADG, lb.	1.68		1.68
Type <sup>1</sup>	11.5		12.2
Index	106		110
<u>Postweaning</u>			
Number	8		12
Age in days	432		433
Final wt., lb.	789		815
ADG, lb.	2.15		2.33
Wt./Day of age, lb.	1.83		1.88
Type <sup>1</sup>	12.0		12.4
Index <sup>2</sup>	115.1		119.2
Feed/cwt. gain	816		813

1) 11 = high good, 12 = low choice, 13 = average choice

2) (Wt./day of age x 40) + (Type x 5) - 18 = Postweaning index

TABLE 2. Carcass Data of Bulls by Two Different Sires

Item	Sire		
	SP 194	HP	RS 15
Number	7		10
Wt. at Slaughter, lb.	889		913
Cold Carcass wt., lb.	509		536
Dressing percent	57.3		58.6
Hide wt., lb.	75.6		77.5
Conformation <sup>1</sup>	12.1		13.5
Marbling Score <sup>2</sup>	3.9		3.9
Ribeye area, sq. in.	12.3		12.1
Fat thickness, in.	0.34		0.42
Kidney Fat percent	2		2

TABLE 2. Continued

Item	Sire	
	SP 194	HP RS 15
Quality <sup>1</sup>	10.0	10.1
Yield Grade <sup>3</sup>	1.7	2.2
Carcass Grade <sup>1</sup>	10.0	10.1
Color of fat <sup>4</sup>	2	2
Color of lean <sup>5</sup>	6.0	7.3
Wt. of rib, lb.	22.0	22.8
Percent fat	26.7	30.6
Percent lean	57.9	54.5
Percent bone	15.4	15.9
W-B shear force, lb.	16.1	16.5
Palatability <sup>7</sup>		
Flavor	7.56	7.47
Juiceness	7.45	7.33
Tenderness	7.37	7.19
Overall satisfaction	7.46	7.37

1) 10 = average good, 11 = high good, 12 = low choice, 13 = average choice

2) 3 = traces, 4 = slight

3) The lower the yield grade the greater the estimated percent lean cuts

4) 2 = creamy white

5) The higher the number the darker the lean

6) 1-inch cores roasted at 325° to an internal temperature of 160° in an electric oven

7) Average of 3 scores. The higher the number the more desirable

TABLE 3. Preweaning Data for 1964 Calf Crop

Item	Bulls	Heifers
Number	40	35
Adj. ADG, lb. <sup>1</sup>	1.60	1.64
Type <sup>2</sup>	12.0	12.1
Index	106	108

1) Adjusted for age of dam, sex of calf and season of birth

2) 12 = low choice, 13 = average choice

TABLE 4. Postweaning Data for 1964 Calf Crop

Item	Bulls <sup>1</sup>	Steers <sup>1</sup>	Heifers <sup>1</sup>
Number	20	17	34
ADG on test, lb.	2.42	2.25	1.23
Wt./Day of age, lb.	2.00	1.58	1.45
Type <sup>2</sup>	12.4	11.3	11.9
Index <sup>3</sup>	124	102	99

1) Bulls, steers, and heifers were fed different rations

2) 11 = high good, 12 = low choice, 13 = average choice

3) Index = (Wt./day of age x 40) + (Type x 5) - 18

TABLE 5. Princeton and Quicksand Postweaning Bull Test Data by Breeds

Breed	No.	Age, Days	ADG <sup>1</sup>	Wt/Day of age	Type <sup>2</sup>	Index <sup>3</sup>
<u>Princeton</u>						
Angus	19	393	2.43	2.36	12.1	135
Hereford	22	393	2.68	2.45	12.2	142
P. Hereford	17	400	2.48	2.45	11.8	139
Shorthorn	1	355	2.47	2.35	14.0	146
Brangus	1	384	2.64	2.68	11.0	144
<u>Quicksand</u>						
Angus	8	419	2.22	2.13	12.9	132
Hereford	12	400	2.17	2.07	12.5	128
P. Hereford	11	398	2.41	2.33	12.6	138
Shorthorn	2	367	2.48	2.27	12.6	135

1) Average daily gain on 140-day feeding period

2) 11 = high good, 12 = low choice, 13 = average choice, 14 = high choice

3) Index = (Wt./Day of age x 40) + (Type x 5) - 18

V. FUTURE PLANS:

Future plans are to proceed according to the project outline as rapidly and as extensively as time and facilities permit.

VI. PUBLICATIONS DURING THE YEAR:

Bradley, N. W., D. G. Steele, W. P. Garrigus, and J. D. Kemp 1964.  
Measurement and selection of economically important traits in beef cattle.  
Animal Science Research Reports.

VII. PUBLICATIONS PLANNED:

Results will be published annually in the Kentucky Animal Science Research Reports and elsewhere as justified.

Submitted by: N. W. Bradley

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Kentucky

Location	Coldstream	Mercer	Princeton	Eden Shale	Mereworth
Breed of sire	Hereford	Hereford	Hereford	Hereford	Hereford
Breed of dam	Hereford	Hereford	Hereford	Hereford	Hereford
Line or group	Station	Station	Station	Station	Co-op
Percent used in project	100	100	100	100	100
Inventory as of July 1, 1965	Cows 2 years and over		43	84	19
	Yearling heifers	7	1	39	
	Bulls and steers under 1 year			35	
	Heifers under 1 year			43	
	Bulls over 1 year	20	2	5	3
	Steers over 1 year	17			
Repro. perf.	Percent pregnant <sup>1</sup>		b	b	b
	Calf survival percent <sup>2</sup>		b	b	b
Wean. perf.	Adj. ADG <sup>3</sup>			1.62	
	Av. type sc.			12.1	
Postweaning performance	No. of bulls <sup>c</sup>	20			
	No. of heifers <sup>d</sup>	7		34	
	No. of steers <sup>d</sup>	17			
Slaughtered perf.	No. of bulls	17			
	No. of heifers				
	No. of steers				

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

<sup>a</sup>Used for progeny testing.

<sup>b</sup>It was not possible to determine calving percentages due to reorganization and relocation of cattle in the project.

<sup>c</sup>1964 calves.

<sup>d</sup>1963 calves.

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Kentucky

Location	Princeton	Princeton	Princeton	Princeton	Coldstream
Breed of sire	Angus	Polled Hereford	Shorthorn	Brangus	Hereford
Breed of dam	Angus	Polled Hereford	Shorthorn	Brangus	Hereford
Line or group	Co-op	Co-op	Co-op	Co-op	Co-op
Percent used in project					100
Inventory as of July 1, 1965	Cows 2 years and over				
	Yearling heifers				8
	Bulls and steers under 1 year				
	Heifers under 1 year				
	Bulls over 1 year				
	Steers over 1 year				26
Repro. perf.	Percent <sup>1</sup> pregnant				
	Calf survival percent <sup>2</sup>				
Wean. perf.	Adj. ADG <sup>3</sup>				
	Av. type sc.				
Postweaning performance	No. of bulls	19	17	1	1
	No. of heifers				8
	No. of steers				26
Slaughtered	No. of bulls				
	No. of heifers				
	No. of steers				

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

FORM I

PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Kentucky

Location	Quicksand	Quicksand	Quicksand	Quicksand	Princeton
Breed of sire	Angus	Hereford	Polled Hereford	Shorthorn	Hereford
Breed of dam	Angus	Hereford	Polled Hereford	Shorthorn	Hereford
Line or group	Co-op	Co-op	Co-op	Co-op	Co-op
Percent used in project	0	0	0	0	0
Inventory as of July 1, 1965	Cows 2 years and over				
	Yearling heifers				
	Bulls and steers under 1 year				
	Heifers under 1 year				
	Bulls over 1 year				
	Steers over 1 year				
	Percent pregnant <sup>1</sup>				
Repro. perf.	Calf survival percent <sup>2</sup>				
	Adj. ADG <sup>3</sup>				
Wean. perf.	Av. type sc.				
	No. of bulls	8	12	11	2
Postweaning performance	No. of heifers				
	No. of steers				
	No. of bulls				
Slaughtered	No. of heifers				
	No. of steers				

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

LOUISIANA STATE UNIVERSITY  
Agricultural Experiment Station

I. PROJECT: 605 (S-10)

Comparison of Various Crossbred Cattle Under Gulf Coast Conditions with Respect to Rate of Growth on Pasture, Fattening Ability, and Meat Quality of Steers

II. OBJECTIVES:

To study types and breeds of beef cattle to determine which are best suited to Gulf Coast conditions, with respect to rate of growth, fattening ability, and meat quality.

To study various crossbreeding programs as to practicality, production, and usefulness.

To study the amount of hybrid vigor obtained through crossing beef breeds and to ascertain how much of this hybrid vigor is maintained through subsequent backcrossing, multiple-breed crossing, and rotational crossing.

To study the productive ability of dams of various breeds and breed crosses.

To estimate genetic parameters.

To study practical problems of management and marketing of crossbred cattle in the Gulf Coast area.

III. PERSONNEL:

Noah England, A. M. Mullins, R. F. Boulware, C. C. Phillips, John S. Sullivan, and Dorothy Wilson

IV. ACCOMPLISHMENTS DURING THE YEAR:

The 1964 calves were the twelfth group produced on the beef cattle crossbreeding project and the fourth since the project was revised to include the production of contemporary purebreds, first crosses, backcrosses and three-breed crosses. Summaries of preweaning and postweaning performance over the past 4 years are given by mating system and breed of sire in tables 1 and 2.

TABLE 1. Summary of Calf Performance by System of Mating

Group	Both Sexes (1961-64)			Steers on Feed (1961-64)		
	Number of calves	205-day		Number of steers	Rate of gain on feed	Carcass grade
		wt. adj. sex calf age dam	Feeder Grade			
Straightbreds	124	386	9.9	58	1.84	10.5
Single crosses	217	415	10.4	104	2.03	10.9
Backcrosses	258	455	10.7	129	1.93	11.0
3-Breed crosses	276	456	10.8	144	1.95	11.3

TABLE 2. Summary of Performance by Breed of Sire

Group	Both Sexes (1961-64)			Steers on Feed (1961-64)		
	Number of calves	205-day		Number of steers	Rate of gain on feed	Carcass grade
		wt. adj. sex calf age dam	Feeder grade			
Angus	141	405	10.7	73	1.88	11.9
Brahman	134	442	9.7	72	1.84	9.7
Brangus	147	429	10.4	86	2.00	10.7
Charolais	172	475	10.6	62	1.98	10.2
Hereford	122	426	11.3	62	1.96	10.8
Shorthorn	146	426	11.0	79	1.97	11.9

Data taken during the first eight years of the study (1953-1960) were analyzed to determine the preweaning growth rates of steer and heifer calves produced by Angus, Brahman, Brangus, and Hereford cows. Growth rates of purebred calves on purebred cows, crossbred calves on purebred cows, and crossbred calves on crossbred cows were also compared.

The average weight difference at 224 days for all breeds was 31 pounds in favor of steer calves. Sex differences in weaning weight in favor of steers by breed of dam were 41, 20, 32, and 31 pounds for Angus, Brahman, Brangus, and Hereford, respectively. Sex differences in calves from Angus dams were significant at 28 days of age and all ages thereafter. From Brangus and Hereford cows sex differences at 28 days were non-significant but the differences at 112 days were statistically significant, while weight of steers and heifers from Brahman dams were significantly different only at 224 days of age (table 3). It is possible that sex differences appear earliest in cattle that mature most rapidly and latest in cattle that mature more slowly.

Crossbred calves were heavier at all ages than were purebred calves; however, these differences were not large enough to be statistically significant until the calves reached 112 days of age. These data indicate that crossbred calves grew somewhat more rapidly than purebred calves throughout the entire preweaning period (table 4).

The preweaning growth curve was different for calves from British-breed cows, as compared with calves from Brahman and Brangus cows. Calves from all four breeds of dam (Angus, Brahman, Brangus, and Hereford) grew at about the same rate for the first 140 days. At that time, growth rate of calves from British breed cows decreased while the growth rate of calves from Brahman and Brangus cows remained relatively constant. This would seem to indicate greater persistency of lactation in Brahman-type cows (table 3). These data support the conclusion that the effect of age of calf on weaning weight varies considerably from one breed to another.

During the past year a study was made to determine if reciprocal-cross beef females are equally good for use as brood cows. It is well known that reciprocal crosses do not themselves wean at the same weights if the two breeds used for crossing differ in mothering ability. It has been generally assumed, however, that reciprocal crosses would be equally productive when used as dams since they would be essentially the same in genetic constitution.

Six sets of reciprocals were used in this study. The types of reciprocals used and a summary of the information yielded by the study are given in table 5. It is apparent that reciprocal-cross cows resulting from wide crosses are not equally productive insofar as the weaning weight of their calves is concerned. When the breeds involved in the original cross are very similar, the reciprocal crosses themselves are quite similar in productivity. It is quite possible that the differences between reciprocal-cross cows is due to a permanent effect of their own early maternal environment.

TABLE 3. Weight Differences Between Sexes for Calves of Various Ages

Breed and Classification	28	Age (days)	112	224
Angus				
Steers	120	283		447
Heifers	104	255		406
Difference	16**	28**		41**
Both sexes	112	269		425
Brahman				
Steers	104	262		468
Heifers	101	265		448
Difference	3 n.s.	- 3 n.s.		20**
Both sexes	102	265		460
Brangus				
Steers	121	299		491
Heifers	116	280		459
Difference	5 n.s.	19**		32**
Both sexes	118	289		475
Hereford				
Steers	121	273		443
Heifers	112	258		412
Difference	9 n.s.	15**		31**
Both sexes	116	265		425
All Breeds				
Both sexes	111	273		444

\*P = < 0.05

\*\*P = < 0.01

TABLE 4. Weight Differences for Purebred and Crossbred Calves at Various Ages

Classification	28	56	Age (days)	112	168	224
Steers						
P/P	119	166		268	359	440
C/P	118	175		284	382	470
Difference	1 n.s.	9 n.s.		16**	23**	30**

TABLE 4. Continued

Classification	Age (days)				
	28	56	112	168	224
<b>Heifers</b>					
P/P	102	154	251	335	409
C/P	110	167	268	363	440
Difference	8 n.s.	13 n.s.	17**	28**	31**
<b>Steers</b>					
P/P & C/P	119	171	276	371	455
C/C	111	169	277	373	457
Difference	8 n.s.	2 n.s.	1 n.s.	2 n.s.	2 n.s.
<b>Heifers</b>					
P/P & C/P	109	161	260	349	425
C/C	105	163	268	357	430
Difference	4 n.s.	2 n.s.	8**	8**	5**

P/P = purebred calf-purebred dam

C/P = crossbred calf-purebred dam

C/C = crossbred calf-crossbred dam

\* P < 0.05

\*\* P < 0.01

TABLE 5. Mean Birth Weight and Weaning Weight for Calves  
Produced by Reciprocal-Cross Cows

Breed of Dam <sup>1</sup>	Number	Birth weight	Adjusted <sup>2</sup> 205-day weight
Angus x Brahman	39	68.3	476.1
Brahman x Angus	32	63.3	441.2
Difference		5.0*	34.9**
Angus x Brangus	40	73.3	427.8
Brangus x Angus	21	72.8	420.9
Difference		0.5	6.9
Angus x Hereford	39	71.7	411.9
Hereford x Angus	38	72.5	412.1
Difference		0.8	0.2
Brahman x Brangus	56	68.6	450.9
Brangus x Brahman	21	66.3	462.6
Difference		2.3	11.7

TABLE 5. Continued

Breed of Dam <sup>1</sup>	Number	Birth weight	Adjusted <sup>2</sup> 205-day weight
Brahman x Hereford	49	71.6	468.2
Hereford x Brahman	55	71.1	484.4
Difference		0.5	16.2*
Brangus x Hereford	33	77.3	462.4
Hereford x Brangus	46	73.9	439.5
Difference		3.4	22.9*

\*P < 0.05

\*\*P < 0.01

<sup>1</sup>Breed appearing first is the breed of the dam's sire

<sup>2</sup>Adjusted for age of dam, age of calf, sex of calf, breed of sire, and year

A summary of calving dates and calving percentages by various sire-dam breed combinations (table 6) indicates that Brahman bulls show some degree of selectivity as to the kind of cows they mate with. Observation of the breeding behavior of Brahman bulls over the past 12 years has brought out the fact that some Brahman bulls definitely show strong preference for Brahman-type cows. Further work is needed on this subject before definite conclusions are drawn, however.

The study on age at puberty was continued. There is very strong evidence that breed crossing results in an appreciable amount of heterosis for this trait. A number of crossbred heifers have calved at two years of age and have done so with little difficulty.

TABLE 6. A Summary of Calving Percentages and Calving Dates Over a 5-Year Period<sup>1</sup>

Type of Mating		Calving Percentage	Calving Date (Days after Jan. 1)
Male	Female		
Angus	Angus	75	33
Angus	Brahman	75	48
Angus	Brangus	80	46
Angus	Hereford	63	35
Brahman	Brahman	68	46
Brahman	Angus	46	29
Brahman	Brangus	65	39
Brahman	Hereford	48	34

TABLE 6. Continued

Type of Mating		Calving percentage	Calving Date (Days after Jan. 1)
Male	Female		
Brangus	Brangus	74	48
Brangus	Angus	54	28
Brangus	Brahman	54	31
Brangus	Hereford	55	31
Hereford	Hereford	67	26
Hereford	Angus	62	28
Hereford	Brahman	72	42
Hereford	Brangus	66	38
Average		64	36

<sup>1</sup>Data are adjusted for effects of year and lactation status.

V. FUTURE PLANS:

The project will be continued. It is anticipated that a project revision will be put into effect during the 1966 breeding season.

VI. PUBLICATIONS DURING THE YEAR:

Chapman, H. D. and Noah England. 1965. A comparison of the reproductive performance of cows mated to bulls of their own breed vs. that of cows mated to bulls of different breeds. *J. Animal Sci.* 24:289 (Abs.)

England, Noah and B. R. Farthing. 1964. Comparative performance of reciprocal crosses in beef cattle. *J. Animal Sci.* 23:848 (Abs.)

England, Noah and G. L. Robertson. 1964. Crossbreeding for beef production. *Louisiana Agriculture*, Vol. 7. 3:12.

England, Noah and D. E. Franke. 1965. What type of crossbred produces best? *Louisiana Agriculture*, Vol. 8. 3:10.

Franke, D. E., Noah England and J. E. Hendry. 1965. Effect of breed of dam and breed of sire on birth weight of beef calves. *J. Animal Sci.* 24:281 (Abs.).

Phillips, C. C. 1964. Some genetic and environmental factors affecting preweaning growth in purebred and crossbred beef calves. Master's Thesis. Louisiana State University, Baton Rouge, Louisiana.

Sullivan, J. S., Noah England and B. R. Farthing. 1964. Effect of type of dam and type of calf upon growth rates of beef calves from birth to weaning. J. Animal Sci. 23:854 (Abs.).

VII. PUBLICATIONS PLANNED:

Comparative progress from selection in purebred and crossbred beef heifers.

Submitted by: Noah England

EXPLANATORY NOTES

for

PRODUCTION, INVENTORY, AND PERFORMANCE DATA SHEETS  
FORM I

Louisiana Project 605 (S-10)

- (a) Dams: Straightbreds - Angus, Brahman, Brangus and Hereford  
Single crosses - A-B, A-BA, A-H; B-A, B-BA, B-H; BA-A, BA-B,  
BA-H; C-A, C-B, C-BA, C-H; H-A, H-B, H-BA;  
and S-A, S-B, S-BA, and S-H.
- (b) Straightbreds and single crosses.
- (c) Two-year-old heifers (straightbreds, single crosses, backcrosses and  
three-breed crosses) artificially bred.

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Louisiana

Location	Baton Rouge	Baton Rouge	Baton Rouge	Baton Rouge	Baton Rouge
Breed of sire	Angus	Angus	Brahman	Brahman	Brangus
Breed of dam	Angus	(a)	Brahman	(a)	Brangus
Line or group	Straight-bred	(b)	Straight-bred	(b)	Straight-bred
Percent used in project	100	100	100	100	100
Inventory as of July 1, 1965	Cows 2 years and over	10	45	11	44
	Yearling heifers	4	10	3	8
	Bulls and steers under 1 year	3	20	2	10
	Heifers under 1 year	1	27	1	16
	Bulls over 1 year	2	0	2	0
	Steers over 1 year	0	0	0	0
	Percent pregnant <sup>1</sup>	61.5	70.2	91.7	57.8
Repro. perf.	Calf survival percent <sup>2</sup>	87.5	93.9	90.9	96.2
	Adj. ADG <sup>3</sup>	1.27	1.57	1.49	1.75
Wean. perf.	Av. type sc.	10.90	11.18	9.63	10.62
	No. of bulls				
	No. of heifers				
Postweaning performance	No. of steers	1	15	4	14
	No. of bulls				
	No. of heifers				
Slaughtered	No. of steers	1	15	4	14

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Louisiana

Location	Baton Rouge	Baton Rouge	Baton Rouge	Baton Rouge	Baton Rouge
Breed of sire	Brangus	Charolais	Charolais	Charolais	Charolais
Breed of dam	(a)	Charolais	Charolais crosses	Charolais Crosses	(a)
Line or group	(b)	Straight-bred	Single cross	Backcross	(b)
Percent used in project	100	100	100	100	100
Inventory as of July 1, 1965	Cows 2 years and over	42	2	16	61
	Yearling heifers	13	0	7	12
	Bulls and steers under 1 year	15	0	1	14
	Heifers under 1 year	9	1	4	23
	Bulls over 1 year	0	2	3	0
	Steers over 1 year	0	0	0	1
	Percent pregnant <sup>1</sup>	86.0	0	100	43.5
Repro. perf.	Calf survival percent <sup>2</sup>	91.9	0	87.5	90.0
	Adj. ADG <sup>3</sup>	1.59	0	1.96	1.92
	Av. type sc.	10.82	0	11.45	11.59
Postweaning performance	No. of bulls				
	No. of heifers				
	No. of steers	19	0	1	5
Slaughtered	No. of bulls				
	No. of heifers				
	No. of steers	19	0	1	5

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Louisiana

Location	Baton Rouge	Baton Rouge	Baton Rouge	Baton Rouge	Baton Rouge
Breed of sire	Hereford	Hereford	Shorthorn	Angus	
Breed of dam	Hereford	(a)	(a)	(c)	
Line or group	Straight-bred	(b)	(b)		
Percent used in project	100	100	100	100	Total No. Animals
Inventory as of July 1, 1965	Cows 2 years and over	12	47	0	371
	Yearling heifers	5	16	0	94
	Bulls and steers under 1 year	4	18	6	108
	Heifers under 1 year	3	14	7	109
	Bulls over 1 year	2	0	0	14
	Steers over 1 year	0	0	0	1
	Percent pregnant <sup>1</sup>	41.7	74.5	82.5	92.0
Repro. perf.	Calf survival percent <sup>2</sup>	80.0	100.0	91.5	87.0
	Adj. ADG <sup>3</sup>	1.36	1.70	1.67	1.40
Wean. perf.	Av. type sc.	11.58	11.57	11.08	---
	No. of bulls				
	No. of heifers				
Postweaning performance	No. of steers	2	12	23	0
	No. of bulls				
	No. of heifers				
Slaughtered	No. of steers	2	12	23	0
	No. of bulls				
	No. of heifers				

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

IBERIA LIVESTOCK EXPERIMENT STATION  
Jeanerette, Louisiana

I. PROJECT: AHRD Line Project dl-6 (Revised 1958)

Development of Pure and Crossbred Types of Beef Cattle for the Southeastern United States and the Gulf Coast Region

II. OBJECTIVES:

To compare and assess the performance of the Brangus, Africander-Angus, Angus, and Brahman for beef.

To study and evaluate carcass merit and meat quality of progeny from the crossbred lines, purebreds, and other crosses.

To assess the progress of the Brangus by comparing them to the first crosses and the two parent breeds.

To evaluate the combining ability of Angus and Brahman bulls when mated to samples of Brangus and Africander-Angus cows by measuring the growth and carcass merit of the progeny.

To study fertility among the several breed groups under normal management procedures.

III. PERSONNEL:

T. M. DeRouen, W. L. Reynolds, J. W. High, Jr.\*, D. C. Meyerhoeffer\*\*, Noah England, A. M. Mullins, R. F. Boulware, R. S. Temple, and E. J. Warwick.

\* Resigned - July 1, 1964

\*\* Employed - August 12, 1964

IV: ACCOMPLISHMENTS DURING THE YEAR:

1. Scope and nature of work.

The studies have been continued and data have been collected on the several aspects of the project. Fertility investigations have been extended to include studies on postweaning performance of cull cows in the fall. Cow production information has been examined in an effort to evaluate factors affecting the performance of the various breed groups and crosses. The steers were fed by breed groups in order to calculate feed consumption and efficiency. Detailed carcass data were obtained on the progeny of the several breed groups and crosses.

2. Research results.

a. Breeding season and conception. A total of 235 cows were sorted into 15 single-sire herds for breeding on pasture on April 15. The bulls remained in the breeding herd for 75 days. Two of these herds were artificially bred. Bulls were tested for semen quality just prior to placing in the herd. A record of estrus was obtained on each cow in the breeding herds.

All cows exposed to bulls during the breeding season were palpated for pregnancy during late August and early September. Conception rates for 1963 for the various breeds and crosses were: Brangus, 84 percent; Angus, 80 percent;  $F_1$  crosses, 93 percent; Africander-Angus, 93 percent; and Brahman, 84 percent. The over-all conception rate was 86 percent.

b. Calving and weaning performance. Calving began on January 15, 1964, and the last calf was born on April 20. Mortality of calves during the first 72 hours following parturition was five percent. The calving losses are shown in table 1.

TABLE 1. Calving Report for 1964

Breed of Calf	Born			Percent live
	Live	Dead	Total	
Brangus	63	0	63	100
Africander-Angus	34	3	37	92
Angus	32	0	32	100
Brahman	18	5	23	78
Brangus x $F_1$	13	0	13	100
Charolais x $F_1$	13	1	14	93
Charolais x Brangus	11	0	11	100
Totals	184	9	193	95

Not shown in the above table is the mortality of Brahman and Brangus calves during the first month following birth. These losses were 22 percent and 8 percent for the Brahman and Brangus calves, respectively.

No creep feed was given to any of the calves.

c. Postweaning performance. Bull calves were selected at weaning in September 1963. The selected calves were placed on a gain-evaluation test for 140 days, and were full-fed in dry lot. The ration fed was composed of 75 percent concentrates and 25 percent roughage. The chemical analysis of the ration is presented in table 2.

TABLE 2. Chemical Analysis of Ration

Protein .....	11.3 Percent
Nitrogen free extract .....	56.2 Percent
Fat .....	3.5 Percent
Fiber .....	11.6 Percent
Water .....	13.5 Percent
Ash .....	3.9 Percent

Approximately 2000 Vitamin A, USP units were added per pound of feed.

All calves were started on feed on October 1, 1963. A summary of the postweaning performance of the bulls is presented in table 3.

TABLE 3. Postweaning Performance of Bulls -  
Fed in 1963-64

Line or group	Brangus	Angus	Brahman	Afric-Angus
Breed of sire	Brangus	Angus	Brahman	Afric-Angus
Breed of dam	Brangus	Angus	Brahman	Afric-Angus
No. in group	20	7	4	1
Av. init. wt.	427	372	410	450
No. days fed	140	140	140	140
Av. final wt.	772	726	706	850
ADG on test	2.46	2.53	2.11	2.86
Av. age end test	368	384	360	376
Av. type score	10.0	12.0	11.0	10.0
Av. cond. score	9.0	10.0	9.0	9.0
Av. inbreeding	13.91	none	none	4.98
Feed/day	17.25	18.60	17.17	18.77
Feed/lb. gain	7.03	7.34	8.11	6.57

All steers were group fed in dry lot by breed or breed combination. The ration used was the same as that fed to the bulls. Data on postweaning performance is shown in table 4.

Since there were such small numbers in each breed combination, these heifers were full-fed in one group in dry lot. The ration was the same as that fed to the bulls and steers.

The average daily feed consumed per head was 17.36 pounds. The feed required per pound of gain was 10.38. A summary of the performance of the heifers is presented in table 5.

TABLE 4. Postweaning Performance of Steers - Fed in 1963-64

-106-  
La., Jen. 4

Line or group	Afri-Ang.	Angus	F <sub>1</sub>	CA <sup>a</sup>	CA <sup>a</sup>	CA <sup>a</sup>
Breed of sire	Afri-Ang.	Angus	Brahman	Angus	Angus	Brangus
Breed of dam	Afri-Ang.	Angus	Angus	Brahman	Afr-Ang	F <sub>1</sub>
No. in group	6	4	6	8	5	4
Av. init. wt.	368	330	497	411	406	365
No. days fed	196	196	196	196	196	196
Av. final wt.	723	675	932	766	828	725
ADG on test	1.81	1.76	2.22	1.81	2.15	1.84
Av. age end test	444	454	445	421	423	448
Av. type score	9.0	11.0	11.0	8.0	10.0	11.0
Av. cond. score	9.0	11.0	12.0	9.0	11.0	11.0
Av. inbreeding	17.42	none	none	none	none	none
Feed/day	16.24	15.79	22.21	17.92	20.55	18.48
Feed/lb. gain	8.96	8.97	10.00	9.88	9.55	10.06

<sup>a</sup>CA = Combining ability

TABLE 5. Postweaning Performance of Heifers -  
Fed in 1963-64

Line or group	CA	CA	CA	CA
Breed of sire	Angus	Angus	Brahman	Brahman
Breed of Dam	Af-Ang	Brangus	Af-Ang	Brangus
No. in group	4	5	2	4
Av. init. wt.	361	318	430	368
No. days fed	168	168	168	168
Av. final wt.	621	608	722	652
ADG on test	1.55	1.73	1.74	1.70
Av. age end test	422	398	413	387
Av. type score	11.2	10.8	9.1	9.6
Av. cond. score	11.8	11.0	9.5	9.5

d. Slaughter data. A summary of the slaughter information is presented in tables 6 and 7 for the steers and for the heifers.

e. Postweaning breeding performance of cows for 1964. Twenty-seven cull cows which nursed calves in 1964 and were palpated open at the end of a 75-day breeding season were placed with fertile bulls in September after the calves were weaned. The cows were exposed to a bull for 42 days to determine pregnancy rate. Twenty-five days after the end of the breeding period the cows were slaughtered, and the reproductive organs were recovered and examined for signs of pregnancy.

A classification of the cows by carcass grade at the time of slaughter showed that only 50 percent of the cows grading Canner showed heat. Seventy-five percent of the cows grading Cutter and 89 percent of the cows grading Utility, showed heat. The pregnancy rate of Canner, Cutter, and Utility cows was 17, 50, and 78 percent respectively. These data indicate, as do those of previous years, the relationship of condition to pregnancy rate. The average pregnancy rate of all cows bred was only 52 percent. The average pregnancy rate of cows not conceiving in the regular season and re-bred in the fall is low.

f. Evaluation of roughages for wintering weanling and yearling heifers. This investigation was initiated in 1962 to evaluate the nutrient qualities and economy of home grown roughages for wintering weanling and yearling replacement beef heifers. Roughages studied were grass hay, sorghum silage, corn silage, and grass (oat) silage. The objective of the test is to evaluate these roughages when feeding them according to National Research Council requirements to make specified gains.

All groups of heifers were fed and handled to make similar growth since the females used in the study were part of the breeding project.

TABLE 6. Steer Slaughter Data - 1964

Line or group	Afr-Ang	Angus	F <sub>1</sub>	CA <sup>a</sup>	CA <sup>a</sup>	CA <sup>a</sup>
Breed of sire	Afr-Ang	Angus	Brahman	Angus	Angus	Brangus
Breed of dam	Afr-Ang	Angus	Angus	Brangus	Af-Ang	F <sub>1</sub>
Sex	Steers	Steers	Steers	Steers	Steers	Steers
No. slaughtered	6	4	6	8	5	4
Age at slaughter	447	457	448	424	426	11
Days fed	196	196	196	196	196	439
Final wt. (feed lot)	723	675	932	766	828	196
Slaughter wt. <sup>b</sup>	726	682	909	762	823	810
Carcass wt. (cold)	428	395	570	460	493	797
Dressing % (cold)	57.07	57.92	62.71	60.37	59.90	476
Carcass grade (quality)	11.07	12.5	12.7	11.0	11.4	59.72
Carcass grade (yield) <sup>c</sup>	2.6	2.8	3.6	2.8	3.6	11.3
Kidney fat % <sup>c</sup>	3.1	2.9	4.1	3.25	3.9	3.0
Rib-eye/100 lbs.						
carcass (sq. in.)	2.04	2.15	1.86	2.00	1.86	1.91
Marbling sc. <sup>c</sup>	14.7	15.2	14.5	11.5	13.0	12.2
Fat thickness <sup>d</sup>						
over rib-eye (in)	0.30	0.35	0.65	0.65	0.79	0.64
Shear <sup>e</sup>	20.02	20.14	20.69	25.11	22.19	25.58

<sup>a</sup>Combining ability

<sup>b</sup>Obtained just before slaughter

<sup>c</sup>Estimated by Federal grader

<sup>d</sup>Measured at three places and averaged

<sup>e</sup>Core - 1-inch. Method of cooking - deep fat

TABLE 7. Heifers Slaughter Data - 1964

Line or group	CA <sup>a</sup>	CA <sup>a</sup>	CA <sup>a</sup>	CA <sup>a</sup>
Breed of sire	Angus	Angus	Brahman	Brahman
Breed of dam	Af-Ang.	Brangus	Af-Ang	Brangus
Sex	Heifers	Heifers	Heifers	Heifers
No. slaughtered	4	5	2	4
Age at slaughter	423	399	414	388
Days fed	168	168	168	168
Final wt. (feed lot)	621	608	722	652
Slaughter wt. <sup>b</sup>	618	600	712	642
Carcass wt. (cold)	374	369	452	403
Dressing % (cold)	60.52	61.50	63.48	62.77
Carcass grade (quality)	11.0	10.8	12.5	11.5
Carcass grade <sup>c</sup> (yield)	3.1	3.2	3.2	2.8
Kidney fat % <sup>c</sup>	3.88	3.50	4.0	3.25
Rib-eye/100 lbs. carcass (sq. in.)	2.21	2.20	2.06	2.27
Marbling sc. <sup>c</sup>	11.8	11.0	15.5	10.8
Fat thickness <sup>d</sup> over rib-eye (in)	0.61	0.88	0.68	0.52
Shear <sup>e</sup>	29.16	28.27	26.34	37.39

<sup>a</sup>Combining ability

<sup>b</sup>Obtained just before slaughter

<sup>c</sup>Estimated by federal grader

<sup>d</sup>Measured at 3 places

<sup>e</sup>Core - 1-inch. Method of cooking - deep fat.

The trials show similar gains during the winter months for the weanling heifers fed ground grass hay and corn silage according to National Research Council recommendations.

The yearling heifers fed grass hay gained faster than those on grass (oat) silage; however, the silage used in this test was of low quality because of the slow growth due to drouth prior to harvesting.

More pounds of sorghum silage were required per pound of gain than for corn silage with the weanling heifers.

Condition scores of the weanling and yearling heifers at the end of the test were similar for the three treatments.

### 3. Improvement of Facilities

Another portion of the marsh was crowned and drained. A new feed mixing mill was constructed and installed but not completed. Concrete was added to four feed lots and to feed lots for reproduction cattle. A new scale for weighing cattle was installed. Considerable damages caused by hurricane last October 1964, have been repaired.

## V. FUTURE PLANS:

1. Old Project. The present breeding project will terminate when present calves are fed out and the data collected.

### 2. New Projects.

a. An investigation of selection for changes in meatiness of Brangus and Angus cattle has been approved. The objective of the study is to determine if changes in meatiness of Brangus and Angus can be made by selection in opposite directions for fatness, as measured by ultrasonics.

b. A study of the response of selection for adaptability in the Gulf Coast area using Angus cattle has been designed, submitted, and approved.

c. A genetic-environmental interaction study was integrated with the reproduction-physiology investigation. Two divergent breeds, Angus and Brahman, and the first crosses will be used in the study.

3. Improvements. It is planned to continue to crown, drain, and seed the marsh to suitable forages for cattle. Additional fences and cross fences will be constructed for better utilization of pastures. Drainage will be improved where needed. Construction and installation of feed mill will be completed.

## VI. PUBLICATIONS DURING THE YEAR:

DeRouen, T. M., W. L. Reynolds, A. M. Mullins, R. F. Boulware, J. W. High, Jr., R. S. Temple and E. J. Warwick. 1964. Relationship of backfat thickness to economic traits in steers. J. Animal Sci. 23:295. (Abs.)

Reynolds, W. L., T. M. DeRouen, J. W. High, Jr., and R. S. Temple. 1964. Relationship of preweaning to postweaning performance of fed steers and replacement heifers. J. Animal Sci. 23:305. (Abs.)

Reynolds, W. L., T. M. DeRouen, J. W. High, Jr., J. N. Wiltbank, E. J. Warwick and R. S. Temple. 1964. Evaluation of pastures in terms of reproduction of beef cattle. J. Animal Sci. 23:890. (Abs.)

DeRouen, T. M., W. L. Reynolds, J. W. High, Jr., N. T. Poche', and H. C. Gonsoulin. 1964. Beef cattle research at the Iberia Livestock Experiment Station. Fourth Livestock Producers' Day Report. Animal Sci. Department, Louisiana State University and Agricultural Experiment Station.

Station Annual Report

VII. PUBLICATIONS PLANNED:

- A review of the old breeding project.
- An evaluation of milk production of beef cows.
- A review of the gain-evaluation test of bulls.
- A study of shrink in cattle.

Submitted by: T. M. DeRouen

## FORM I

## PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Louisiana

Location	Jeanerette	Jeanerette	Jeanerette	Jeanerette	Jeanerette
Breed of sire	Brangus	Brangus	Brangus	Charolais	Charolais
Breed of dam	Brangus	Brangus	F <sub>1</sub> (AxB)	Brangus	F <sub>1</sub> (AxB)
Line or group <sup>1</sup>	Fat	Combining ability	Combining ability	Combining ability	Combining ability
Percent used in project	100	100	100	100	100
Inventory as of July 1, 1965					
Cows 2 years and over	129	0	0	0	0
Yearling heifers	35	0	0	4	5
Bulls and steers under 1 year	27	5	6	5	6
Heifers under 1 year	40	4	7	5	4
Bulls over 1 year	27	0	0	0	0
Steers over 1 year	0	0	0	0	0
Repro. perf.	Percent pregnant <sup>1</sup>	75	63	88	73
	Calf survival percent <sup>2</sup>	90	100	92	100
	Adj. ADG <sup>3</sup>	1.55	1.53	1.72	1.64
	Av. type sc.	9.0	9.8	10.4	10.4
Postweaning performance	No. of bulls	20	0	0	0
	No. of heifers	14	0	7	0
	No. of steers	0	6	11	0
Slaughtered performance	No. of bulls	0	0	0	0
	No. of heifers	14	0	7	0
	No. of steers	0	6	11	0

1 - Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)

2 - Percent of calves born (dead and alive) that survived to weaning.

3 - Indicate adjustments:

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Louisiana

Location	Jeanerette a	Jeanerette b	Jeanerette	Jeanerette	Jeanerette
Breed of sire	Angus	Angus	Brahman	Angus	Brahman
Breed of dam	Angus	Angus	Brahman	Angus	Angus
Line or group	Purebred	Purebred	Purebred	Fat	F <sub>1</sub>
Percent used in project	100	100	100	100	100
Inventory as of July 1, 1965	Cows 2 years and over	12	31	26	40
	Yearling heifers	0	20	4	54
	Bulls and steers under 1 year	7	12	5	13
	Heifers under 1 year	3	12	5	19
	Bulls over 1 year	0	17	2	0
	Steers over 1 year	0	0	0	0
	Percent pregnant <sup>1</sup>	72	93	80	
Repro. perf.	Calf survival percent <sup>2</sup>	96	91	52	
	Adj. ADG <sup>3</sup>	1.26	1.23	1.58	
	Av. type sc.	10.6	11.5	10.3	
Postweaning performance	No. of bulls		7	4	
	No. of heifers		12		
	No. of steers		4		6
Slaughtered	No. of bulls				
	No. of heifers				
	No. of steers		4		6

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

<sup>a</sup>Artificially bred

<sup>b</sup>Pasture bred

## FORM I

## PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Louisiana

Location	Jeanerette	Jeanerette	Jeanerette	Jeanerette	Jeanerette
Breed of sire	Brahman	Brahman	Angus	Angus	
Breed of dam	Brangus	Afri-Ang	Brangus	Afri-Ang	
Line or group	Combining ability	Combining ability	Combining ability	Combining ability	
Percent used in project	100	100	100	100	
Inventory as of July 1, 1965	Cows 2 years and over				
	Yearling heifers				
	Bulls and steers under 1 year				
	Heifers under 1 year				
	Bulls over 1 year				
	Steers over 1 year				
Repro. perf.	Percent pregnant <sup>1</sup>				
	Calf survival percent <sup>2</sup>				
Wean. perf.	Adj. ADG <sup>3</sup>				
	Av. type sc.				
	No. of bulls				
Postweaning performance	No. of heifers	4	2	5	4
	No. of steers	6	2	5	4
Slaughtered	No. of bulls	0	0	0	0
	No. of heifers	4	2	5	4
	No. of steers	6	2	5	4

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

MISSISSIPPI STATE UNIVERSITY  
Agricultural Experiment Station

I. PROJECT: Hatch 666 (S-10)

A Study to Determine the Breeding Worth of Inbred and Outbred Bulls from Various Sources.

II. OBJECTIVES:

To compare pre- and postweaning growth rates, market grades, carcass qualities, carcass grades, and maternal ability of the progenies of potentially superior sires selected from various sources.

III. PERSONNEL:

C. E. Lindley, George Howse, W. A. Pund, and C. J. Christians

IV. ACCOMPLISHMENTS DURING THE YEAR:

Weights and grades were collected at weaning on 158 Hereford calves from nine bull units, 90 Angus calves from four bull units, and 27 Shorthorn calves from two bull units. Average daily gains from birth to weaning - adjusted for sex and age of dam - and grades were as follows for each Hereford unit: Colo. 9022, 1.76 and 9.4; New Mexico 3, 1.53 and 10.2; Jones 038, 1.64 and 10.1; Victor 982, 1.57 and 9.8; Wilkes W118, 1.61 and 10.7; Jones 051, 1.58 and 9.7; Rankin 737, 1.53 and 10.8; MSU Domino Heir 2, 1.58 and 11.4, and HDR Zato Prince A, 1.57 and 11.2. Gains and grades for Angus units were Va. 0038, 1.69 and 10.3; Woodruff 220, 1.68 and 11.1; College Eileenmere 260, 1.59 and 10.7; and Auburn 9513, 1.61 and 10.5. Gains and grades of the two Shorthorn units were College 541, 1.59 and 10.7; and Valley View VF4, 1.54 and 11.0.

The first five steer calves born from eight Hereford and three Angus bulls were fed on a 224-day feeding test. Detailed carcass and palatability measurements were taken, and some of the results are shown in table 1.

TABLE 1. Carcass Data

Sire group	ADG	Dress				Loin				Shear value
		Car. grade	per- cent	Yield grade	Lgth. carc.	Lgth. leg	Cir. round	eye area		
<b>Hereford</b>										
Va. North Pump										
0188	1.76	10.6	59.0	3.2	44.0	27.8	29.9	8.9	18.0	
Va. Palmer 0187	1.78	10.8	59.8	2.8	46.0	28.7	31.0	10.0	18.6	
Jones 051	1.90	10.0	58.6	3.2	46.5	28.2	30.9	9.9	16.7	
Jones 038	1.98	9.6	59.3	3.2	46.4	28.5	31.8	9.8	22.5	
Rankin 737	1.88	9.8	58.8	2.6	43.9	27.9	31.5	9.6	18.2	

TABLE 1. Continued

Sire group	ADG	Car. grade	Dress per- cent	Yield grade	Lgth. carc.	Lgth. leg	Cir. round	Loin eye area	Shear value
<b>Colo. San</b>									
Juan 6082	1.69	9.8	60.6	2.8	44.0	27.8	30.0	9.5	21.0
New Mexico 3	1.88	10.0	59.4	3.0	43.5	27.3	30.5	8.9	18.8
Colo. Pros. 9022	1.92	10.8	59.9	3.0	45.7	28.6	30.6	9.9	18.9
<b>Angus</b>									
Auburn 7C2	1.72	13.4	62.5	3.4	44.5	27.8	32.0	10.4	20.7
Hawkeye 9P18	1.76	12.2	59.0	2.8	45.0	27.9	29.0	9.8	18.5
Va. 0038	1.66	12.4	60.7	3.2	44.4	27.6	31.5	9.8	16.8

V. FUTURE PLANS:

The testing of various lines and the collection of data on their progeny will be continued. A cooperative agreement with the Virginia Station is being developed to test six inbred lines.

VI. PUBLICATIONS DURING THE YEAR:

Howse, G. H., R. W. Rogers, C. J. Christains, and W. A. Pund. 1965. Comparison of feedlot performance and carcass data of the progeny of various sires. Miss. Annual Livestock Field Day Report.

Lindley, C. E. 1964. Annual Report, Mississippi Farm Research, July 1964.

VII. PUBLICATIONS PLANNED:

Master's Thesis on the effect of various mating systems on various carcass traits.

Submitted by: C. E. Lindley

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Mississippi

Location	Prairie	Prairie	Prairie		
Breed of sire	Angus	Hereford	Shorthorn		
Breed of dam	Angus	Hereford	Shorthorn		
Line or group					
Percent used in project	80	80	80		
Inventory as of July 1, 1965	Cows 2 years and over	141	214	37	
	Yearling heifers	31	45	10	
	Bulls and steers under 1 year				
	Heifers under 1 year				
	Bulls over 1 year				
	Steers over 1 year				
Repro. perf.	Percent pregnant <sup>1</sup>	86.3	78.3	82.5	
	Calf survival percent <sup>2</sup>	89.1	87.8	81.8	
Wean. perf.	Adj. ADG <sup>3</sup>	1.64	1.59	1.57	
	Av. type sc.	10.8	10.3	10.8	
Postweaning performance	No. of bulls				
	No. of heifers				
	No. of steers	15	40	0	
Slaughtered	No. of bulls				
	No. of heifers				
	No. of steers	15	40	0	

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive).  
Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

Adjusted for sex and age of dam.

NORTH CAROLINA STATION  
Agricultural Experiment Station

I. PROJECT: Animal Science H-198, AHRD-d1-23 (S-10)

Genetic and Environmental Interactions for Performance and Carcass Traits in Beef Cattle

II. OBJECTIVES:

To evaluate the importance of sire-by-location interactions for performance traits.

To evaluate sire-by-location and ration interaction for gain and carcass characteristics of steer progeny.

To develop and evaluate selection criteria for the improvement of productive efficiency market quality.

III. PERSONNEL:

E. U. Dillard, J. H. Gregory, J. E. Legates, O. W. Robison, T. N. Blumer, and Kenneth Koonce.

IV. ACCOMPLISHMENTS DURING THE YEAR:

The four herds constituting the genotype-environment study contained a total of 281 cows at the beginning of the 1964 breeding season. As in the previous years of this project, artificial insemination was practiced in all four herds; however, clean up bulls were used in three of the four herds at the end of the season. Conception rate was determined by palpation. A few cows determined to be pregnant were culled for production or disease and sold. Of those kept, less than 2 percent of those diagnosed pregnant failed to calve. Conception rate was generally satisfactory except in one herd where one person was checking heat and he and two others did the breeding. In that herd, only 31 percent of the cows were settled in a 50-day period.

In the postweaning performance test for bull calves of the purebred herd at Raleigh, a total of 22 bulls were on a 154-day test. The performance data for these bulls is shown in the following table.

TABLE 1. Performance Data of 1963 Bull Calves Fed  
for 154 Days Postweaning

Sire No.	No. of Progeny	Average 205-day wt.	ADG on 154 day	Wt/D.A.	Final grade
0030	8	409	2.72	2.27	10.8
0080	9	414	2.68	2.22	10.2
6625	5	372	2.79	2.19	9.4

TABLE 2. Preweaning Performance by Sires and Locations for  
the 1964 Calves

Location	Sire No.	Sex	Number	Adj. 205-day weight	Type score
Raleigh	0030	Bull	6	414	10.7
		Heifer	5	368	10.0
	0100	Bull	4	356	10.3
		Heifer	7	388	9.9
	6630	Bull	7	382	9.4
		Heifer	7	384	9.4
	0030	Steer	6	409	10.0
		Heifer	8	389	9.5
	0100	Steer	11	383	9.6
		Heifer	5	401	9.4
	6630	Steer	3	427	11.0
		Heifer	13	391	9.2
Laurel Springs	0030	Steer	8	402	10.1
		Heifer	8	418	9.8
	0100	Steer	5	360	10.0
		Heifer	10	382	9.6
	6630	Steer	7	365	10.7
		Heifer	4	436	10.3
	0030	Steer	7	350	9.4
		Heifer	12	392	10.1
	0100	Steer	3	342	9.7
		Heifer	15	375	10.2
	6630	Steer	8	389	10.6
		Heifer	8	378	9.6

For the first time yearling heifers were bred in 1964 in three of the herds. In one of these herds, yearling heifers have been bred each year to an Angus bull. In this herd the loss of calves at birth has been somewhat higher than that of the older cows; however, by giving more attention to cows at calving time, losses are not such as to warrant discontinuing the practice.

A total of 409 records gathered on beef cattle at Laurel Springs and Plymouth were analyzed to study the relationship between dam's weight 90 days before calving; dam's changes in weight during the last 90 days of gestation, including parturition; and changes during the first three 60-day periods of lactation with calf's birth weight and calf's gain in 60-day periods, from birth to 180 days of age. The relationship of calf's birth weight to its gain up to 180 days was also studied. In table 3 are shown the means for cows weight and calf gain to 180 days.

TABLE 3. Average Weight of Dams<sup>a</sup> and Average Daily Gain of Calves from 0 to 180 Days of Age

Herd	Age-Class of Dam		
	I	II	III
<b>TRS</b>			
Cow weight	953 + 16	1106 + 27	1158 + 20
Calf gain	1.55 $\pm$ .0014	1.63 $\pm$ .0016	1.77 $\pm$ .0014
<b>UMRS</b>			
Cow weight	939 + 13	1020 + 10	1089 + 11
Calf gain	1.39 $\pm$ .0006	1.57 $\pm$ .0005	1.67 $\pm$ .0004

<sup>a</sup>The average weight of dams was taken by adding the -90, 0, 60, 120, and 180 days weight and dividing by 5.

The results showed that, on the average, cows lost weight during the last part of gestation and the beginning of lactation and gained afterwards. Heavier cows 90 days before calving tended to produce heavier calves at birth and throughout the suckling period, this association being stronger for younger cows. Calf's birth weight was the variable most closely associated with calf's gain. Differences in birth weight accounted for approximately 20 percent of the variation in calf's weight at 180 days of age (Table 4). This is a greater percent of the variation than in the case of calf's gain to 60, 120, or 180 days of age.

The pattern of change in dam's weight was subject to herd and age effects. In the youngest class of dam, cows producing the faster gaining calves showed smaller loss in weight during the last 90 days of gestation and during the first 60 days of lactation and higher gains during the remaining part of the lactation period. Older cows producing the faster gaining calves tended to have greater losses during the first 60 days of lactation and to gain more thereafter. The growth of the young cow probably is in part responsible for the positive association found between her gain and the gain of her offspring.

TABLE 4. Summary of Multiple Regression Analyses on an Among-Dam Class-Herd Basis for the Effect of Independent Variables on Calf's Weight at 180 Days of Age

Age-of-Dam Class	Herd	Error D. F.	Error M. S.	Percentage of Variance in Dependent Variable Accounted for by Independent Variables							
				All Variables	$X_1$	$X_2$	$X_3$	$X_4$	$X_5$	$X_6$	$X_7$
I	TRS	23	728.38	62.30 <sup>b</sup>	0.31	0.69	0.00	0.63	14.86 <sup>a</sup>	30.47 <sup>b</sup>	0.04
	UMRS	62	1274.83	24.07 <sup>b</sup>	8.79 <sup>a</sup>	7.69 <sup>a</sup>	5.44 <sup>a</sup>	5.10	3.02	7.04 <sup>a</sup>	8.21 <sup>a</sup>
II	TRS	13	1229.66	39.55 <sup>b</sup>	0.04	0.04	0.61	0.45	0.15	19.73 <sup>a</sup>	0.08
	UMRS	82	1043.82	26.05 <sup>b</sup>	1.91	0.51	0.39	0.74	0.65	19.64 <sup>b</sup>	4.33 <sup>a</sup>
III	TRS	32	1164.67	58.28 <sup>b</sup>	0.33	2.93	2.40	0.21	0.57	25.84 <sup>b</sup>	0.22
	UMRS	116	1128.16	23.96 <sup>b</sup>	1.35	0.00	0.30	0.01	0.94	10.02 <sup>b</sup>	0.49

<sup>a</sup>Significant at 5 percent probability level

<sup>b</sup>Significant at 1 percent probability level

Variables were:

$x_1$  = Cow's weight 90 days before calving

$x_2$  = Cow's change in weight during the last 90-day period of gestation and including loss at parturition

$x_3$  = Cow's change in weight during the first 60 days postpartum

$x_4$  = Cow's change in weight between 60 days and 120 days postpartum

$x_5$  = Cow's change in weight between 120 days and 180 days postpartum

$x_6$  = Calf's birth weight

$x_7$  = August cow's weight

V. FUTURE PLANS:

No basic changes are planned. At least five years' data will be utilized before deciding any major change.

VI. PUBLICATIONS DURING THE YEAR:

Dillard, E. U., J. E. Legates, T. N. Blumer, R. G. Petersen, O. W. Robison, and J. H. Gregory. 1964. Genotype-environment interactions in beef cattle. J. Animal Sci. 23:848 (Abs.)

Vaccaro, Rodolfo. 1964. Environmental factors influencing preweaning growth in beef cattle. Master Thesis, North Carolina State, Raleigh, North Carolina.

VII. PUBLICATIONS PLANNED:

A publication on correction factors for use in adjusting preweaning data is being prepared.

A publication relating to correlation between dams weight and calf weight is planned.

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965State North Carolina

Location	Raleigh	Plymouth	Laurel Spgs.	Butner	
Breed of sire	Hereford	Hereford	Hereford	Hereford	
Breed of dam	Hereford	Hereford	Hereford	Hereford	
Line or group	Purebred	Grade	Grade	Grade	
Percent used in project	100	100	60	100	
Inventory as of July 1, 1965	Cows 2 years and over	73	74	74	78 <sup>a</sup>
	Yearling heifers	18	25	22	28 <sup>a</sup>
	Bulls and steers under 1 year	20	38	29	
	Heifers under 1 year	28	34	23	
	Bulls over 1 year	7	0	0	
	Steers over 1 year	17 <sup>b</sup>	19	20	
	Percent pregnant <sup>1</sup>	57	84	72	80
Repro. perf.	Calf survival percent <sup>2</sup>	93	88	98	91
	Adj. ADG <sup>3</sup>	1.50	1.58	1.57	1.51
Wean. perf.	Av. type sc.	10.0	9.6	10.0	10.0
	(1963) No. of bulls	22	0	0	
Postweaning performance	No. of heifers	0	0	0	
	(1962) No. of steers	16	20	18	
	(1963) No. of bulls	22	0	0	
Slaughtered	No. of heifers	0	0	0	
	(1962) No. of steers	16 <sup>b</sup>	20	18	

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:  
Adjusted for sex and age of dam.
  - a. Only Grade Hereford cows and replacement females used in this project are counted. Data is not kept on other cattle except the steers moved to Raleigh for feeding.
  - b. Steers at Raleigh were born and raised to weaning at Butner.

CLEMSON UNIVERSITY  
Agricultural Experiment Station

I. PROJECT: SC-479 (S-10)

The Response of Sire Progenies to Management and Feeding Procedures

II. OBJECTIVES:

To investigate the response of sire progenies, as measured by live animal and carcass traits, to methods of producing slaughter cattle.

To evaluate the magnitude and importance of the average genotype with certain environmental influences.

To develop, through selection, herds of beef cattle with superior performance under South Carolina conditions.

III. PERSONNEL:

W. C. Godley, H. H. Pierce, G. C. Skelley, Jr., Mary J. Marbut, R. M. Rauton, R. R. Ritchie, and J. H. Mitchell, Jr.

IV. ACCOMPLISHMENTS DURING THE YEAR:

Eighty-two purebred Hereford cows and 117 purebred Angus cows produced the 1964 calf crop. The 65 Hereford calves weaned were the progeny of four bulls and the 87 Angus calves were also sired by four bulls. One Angus bull was eliminated due to injury and was replaced for the 1964 breeding season with a bull that had been progeny tested in the University herds. One Hereford bull was culled because of the poor performance of his offspring. His replacement had an excellent record and came from one of the top performing herds in the area.

All cows were checked for pregnancy in September of 1963. A summary of the results of the 1963 breeding season is presented in table 1.

TABLE 1. Summary of 1963 Breeding Season

	Coast Station	Clemson Station
No. cows exposed	94	105
No. cows diagnosed pregnant	88	98
No. cows died or sold pregnant	4	2
No. calves born	83*	91
No. calves weaned	73	78
Calving percent weaned	81.11	75.72

\*Twin calves

Twenty cows that were exposed during the 1964 breeding season, but were open according to pregnancy examination, were assembled at the Clemson Station. They were checked twice daily for visual signs of estrus and palpated twice weekly for a 10-week period. Cows showing visual signs of estrus were bred late in the heat period by artificial insemination to bulls known to be highly fertile. Table 2 presents a summary of the results.

TABLE 2. Results of AI on Hard Breeding Beef Cows

Number on test	20
Number cycling during 10-week period, as determined by rectal palpation	20
Number showing estrus and inseminated	19
Number diagnosed pregnant	9
Percent inseminated diagnosed pregnant	47

Thirty-seven Angus and 19 Hereford steers were fed on a postweaning test. These steers were slaughtered and carcass data was obtained. In addition, 27 Angus and 12 Hereford steers from the 1964 calf crop were started on a postweaning test that extended into 1965. Nine Angus bull calves sired by four bulls and nine Hereford calves, also sired by four bulls, were selected for postweaning testing.

V. FUTURE PLANS:

The project will be reviewed and revised as necessary. Plans are to breed at least one sire from both the University Station and the Coast Station to a group of cows at the Edisto Station each year. This will serve to eliminate some of the confounding between sires, stations, and years.

VI. PUBLICATIONS DURING THE YEAR:

Hurst, Victor and W. C. Godley. 1965. Reproduction in Beef Cattle. South Carolina Exp. Sta. Cir. 144.

Wise, J. F. 1964. Estimates of the effects of several factors influencing birth and weaning traits of beef cattle. Master's Thesis. Clemson University. Clemson, South Carolina.

VII. PUBLICATIONS PLANNED:

One Master's Thesis on the effects of different levels of nutrition on sire progeny.

Submitted by: W. C. Godley

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State South Carolina

Location	Summerville	Summerville	Clemson	Clemson	
Breed of sire	Angus	Hereford	Angus	Hereford	
Breed of dam	Angus	Hereford	Angus	Hereford	
Line or group					
Percent used in project	50	50	50	50	
Inventory as of July 1, 1965	Cows 2 years and over	60	51	60	58
	Yearling heifers	22	19	23	19
	Bulls and steers under 1 year	28	20	24	16
	Heifers under 1 year	17	16	21	22
	Bulls over 1 year	2	2	10	10
	Steers over 1 year				
Repro. perf.	Percent pregnant <sup>1</sup>	92.7	94.3	91.2	95.7
	Calf survival percent <sup>2</sup>	89.8	85.3	82.7	89.7
Wean. perf.	Adj. ADG <sup>3</sup>	1.99	1.78	2.10	1.96
	Av. type sc.	11.8	10.8	11.7	10.9
Postweaning performance	No. of bulls	7	4	7	2
	No. of heifers				
	No. of steers	21	6	16	13
Slaughtered	No. of bulls				
	No. of heifers				
	No. of steers	21	6	16	13

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive).  
Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

UNIVERSITY OF TENNESSEE  
Agricultural Experiment Station

I. PROJECT: Hatch 61, AHRD Line Project d1-9 (S-10)

The Improvement of the Producing Ability of Beef Cattle

II. OBJECTIVES:

To develop lines, line crosses, or combinations of lines and crosses of beef cattle which will make the most efficient use of Tennessee pastures and forages and which will result in an improvement of such characters as rate of gain, economy of gain, carcass quality, fertility, and longevity.

To develop effective breeding techniques for the improvement of existing lines of beef cattle.

To investigate the effect of different levels of nutrition on the development of type and conformation, economy of gain, fertility, and longevity.

III. PERSONNEL:

C. S. Hobbs, L. L. Christian, J. B. McLaren, J. W. Cole, C. B. Ramsey, R. A. Reynolds, W. T. Butts, W. L. Sanders, J. H. Felts, and J. A. Odom.

IV. ACCOMPLISHMENTS DURING THE YEAR:

Performance records from birth to weaning were collected on 706 calves. These data include performance records on the progeny of 20 Hereford sires at three locations and 21 Angus sires at three locations.

Two groups of cows which were irradiated in 1961 and 1962, respectively, in connection with the UT-AEC project to evaluate the effect of irradiation on lifetime performance, calved in 1964. Carcass data were obtained on 99 steer and 83 heifer progeny by eight sires from the 1963 calves. Postweaning performance and carcass data will be obtained on 83 steer and 80 heifer progeny by eight sires from the 1964 calves. Weaning data from the 1964 calves were analyzed for sire and management (creep vs. non-creep) effects. A suggestion of a sire x management interaction was noted in this analysis.

Fifty Hereford and Angus bull calves from various stations were used to compare four methods of developing herd bulls from weaning to approximately 20 months of age. A total of 88 Angus and 24 Hereford bull calves from two other locations were fed from weaning to approximately 20 months of age to obtain performance data on individuals and sire progeny.

Data from 15 bull-steer-heifer trios were analyzed to study the effect of sex on performance and carcass traits. Bulls gained faster and more efficiently than steers or heifers, and steers gained faster and more efficiently than heifers. Bull carcasses graded lower than steer or heifer carcasses. Bull meat was less tender, darker, and coarser textured than steer or heifer meat. This study will be continued and modified to include bulls treated with diethylstilbestrol.

Approximately 120 steers and heifers were placed on three experiments to study the effects of level of finish and method of finishing on carcass traits. A group of 36 steers was placed on feed with the rations adjusted to give a slaughter condition of 0.2, 0.4, and 0.6 inches of fat over the rib at the end of the feeding period. Another group of 28 heifers was fed a common ration to be slaughtered as the mean fat thickness of the groups reached 0.2, 0.4, and 0.6 inches, respectively. A third group of 50 steers was divided into five lots and started on a ration of corn silage and limited grain. Each 28 days a lot was placed on full feed of concentrates. The experiment was terminated when the last lot had been on full feed of concentrates for 28 days. These studies will be continued, and data from the first trials will be presented in 1965.

In the cooperative program with the Extension Service, individual calf records have been processed on 3,619 calves, and summaries by sire and herds have been made for 122 breeders. The Tennessee Beef Cattle Improvement Program has been extensively modified to more adequately serve the increased number of cooperating breeders and to provide more field research data.

#### V. FUTURE PLANS:

Present breeding projects will continue at the different locations.

Emphasis will be given to carcass evaluation and consumer acceptance phases.

Progeny testing of bulls developed by different methods at the Oak Ridge Station will be expanded. A random half of each sire progeny will be finished under the postweaning system used to develop the sire and the other half will be finished under the contrasting method. Performance and carcass data will be obtained.

#### VI. PUBLICATIONS DURING THE YEAR:

Cole, J. W., C. B. Ramsey, C. S. Hobbs and R. S. Temple. 1964. Effects of type and breed of British, Zebu, and dairy cattle on production, palatability, and composition. III. Percent wholesale cuts and yield of edible portion as determined by physical and chemical analysis. J. Animal Sci. 23:71.

Cole, J. W., C. B. Ramsey, C. S. Hobbs and R. S. Temple. 1964. Effects of type and breed of British, Zebu, and dairy cattle on production, carcass composition, and palatability. J. Dairy Sci. 10:1138.

Jamison, H. M., L. L. Christian, R. S. Temple, and W. T. Butts, Jr. 1965. Factors affecting variation in intra-cow production in beef cattle. *J. Animal Sci.* 24:287. (Abs.)

Ramsey, C. B., J. W. Cole, R. N. Terrell and R. S. Temple. 1965. Effects of type and breed of British, Zebu, and dairy cattle on production, palatability, and composition. IV. Yield of gastro-intestinal tract and other non-carcass components. *J. Animal Sci.* 24:120.

Ramsey, C. B., R. S. Temple, R. L. Sliger and D. L. Huffman. 1965. Changes in beef muscle area and configuration during slaughter. *J. Animal Sci.* 24:283 (Abs.).

Ramsey, C. B., J. N. Williams, II, C. S. Hobbs, J. W. Cole and R. S. Temple. 1965. Ultrasonic estimates of the biceps femoris as predictors of carcass composition. *J. Animal Sci.* 24:291 (Abs.).

Temple, R. S., C. B. Ramsey and T. B. Patterson. 1965. Errors in ultrasonic evaluation of beef cattle. *J. Animal Sci.* 24:282 (Abs.).

Williams, J. N., II, C. S. Hobbs, C. B. Ramsey and R. S. Temple. 1965. Gains, efficiency, and carcass differences between bulls, steers, and heifers. *J. Animal Sci.* 24:283 (Abs.).

Williams, J. N., II. 1965. Performance, carcass characteristics and ultrasonic estimates of changes in muscle and fat of bulls, steers, and heifers. Ph.D. Thesis, The University of Tennessee, Knoxville, Tennessee.

VII. PUBLICATIONS PLANNED:

None

Submitted by: C. S. Hobbs

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Tennessee

Location	Alcoa	Alcoa	Oak Ridge	Greeneville	Crossville
Breed of sire	Angus	Hereford	Hereford	Polled Hereford	Angus
Breed of dam	Angus	Hereford	Hereford	Polled Hereford	Angus
Line or group	Purebred	Purebred	Grade	Purebred	Purebred
Percent used in project	100	100	100	100	100
Inventory as of July 1, 1965	Cows 2 years and over	101	162	206	61
	Yearling heifers	29	36		12
	Bulls and steers under 1 year	31	36	93	24
	Heifers under 1 year	34	61	73	28
	Bulls over 1 year	6	18		
	Steers over 1 year	0	0		14
Repro. perf.	Percent pregnant <sup>1</sup>	75	80	87	97
	Calf survival percent <sup>2</sup>	97	92	97	93
Wean. perf.	Adj. ADG <sup>3</sup> <sup>a</sup>	1.76	1.76	1.91	1.96
	Av. type sc.	12.5	11.8	11.8	12.1
Postweaning performance	No. of bulls	9	37		10
	No. of heifers	4	12	83	5
	No. of steers	15	53	99	14
Slaughtered	No. of bulls	4	13		
	No. of heifers	4	12	83	5
	No. of steers	15	53	99	14

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:
  - a. Calves raised on foster dam or nurse cow, sick calves, etc. not included.

## FORM I

## PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Tennessee

Location	Ames			
Breed of sire	Angus			
Breed of dam	Angus			
Line or group	Purebred			
Percent used in project	100			
Inventory as of July 1, 1965	Cows 2 years and over	290		
	Yearling heifers	96		
	Bulls and steers under 1 year	100		
	Heifers under 1 year	112		
	Bulls over 1 year	81		
	Steers over 1 year			
Repro. perf.	Percent 1 pregnant	71		
	Calf survival percent <sup>2</sup>	91		
Wean. perf.	Adj. ADG <sup>3</sup> a	1.72		
	Av. type sc.	12.3		
Postweaning performance	No. of bulls	83		
	No. of heifers			
	No. of steers	17		
Slaughtered	No. of bulls			
	No. of heifers			
	No. of steers			

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:
  - a. Calves raised on foster dam or nurse cow, sick calves, etc. not included.

TEXAS A AND M UNIVERSITY  
Agricultural Experiment Station

I. PROJECT: Hatch 714 (S-10)

Biochemical and Fundamental Physiological Changes Occurring with Genetically Variable Growth of Animals

II. OBJECTIVES:

To delineate, by quantitative and mathematical descriptions, certain basic biochemical and physiological changes as they occur with growth of animals.

To evaluate particularly the phenotypic and genetic correlations of certain variations in biochemical and physiological change to modification in patterns of postnatal growth.

To develop methods of biochemical or physiological nature which will measure the potential rate of gain and efficiency of feed utilization in young beef animals.

III. PERSONNEL:

H. O. Kunkel and J. C. Reagor

IV. ACCOMPLISHMENTS DURING THE YEAR:

The positive relationships among the degree of tolerance to insulin, ruminal development, and extent of growth of lambs have been verified and now provide one of the very best systems demonstrating metabolic change associated with morphologic development and growth in the ruminant animal.

Sample analyses are nearing completion on an experiment designed to investigate further whether the tolerance to insulin is dependent upon ruminal development or is a phenomenon associated with growth *per se*. Normal development of the ruminal epithelium, but not growth, was inhibited by maintaining young lambs on an all milk diet up to 12 weeks of age. After this inhibition period, the lambs were placed on solid feed for an additional five weeks, thereby allowing for sufficient ruminal development to remove the diurnal variations of blood sugar observed at 12 weeks in the milk-fed lamb. Previous study demonstrated that these variations must be removed when comparing data on insulin tolerance of such treated lambs with those from lambs possessing normal ruminal development. This study should clarify the correlation between ruminal development and insulin tolerance as the relationship may be dependent upon conditions, or a set of circumstances, which normally have only a casual occurrence with ruminal development.

Further experimentation was completed on the possible relationship of insulin tolerance and feedlot performance, especially with respect to compensatory growth and body weight gain. However, results from insulin tolerance tests administered to lambs prior to a 120-day feeding period are not conclusive and do not yet allow prediction of that part of relative gains due to compensatory growth.

A study was initiated to explore the enzymatic adaptations associated with the marked change in carbohydrate metabolism of the developing ruminant. Glucokinase, an enzyme whose synthesis has been shown to be controlled by insulin in the rat, was initially chosen for the study as insulin tolerance has been repeatedly shown to be related to ruminal development. Under the assay procedure employed, hexokinase values were also noted. Twenty-eight lambs ranging in age from 24 hours to 17 weeks of age were slaughtered for the determination of hepatic glucokinase and hexokinase activities. The results to date show a 75 percent decrease in hexokinase activity with increasing age to 17 weeks and with ruminal development, while glucokinase activity is low and unchanged. Neither of the enzymes measured were affected by insulin administered 24 hours before sacrifice.

Fourteen wether lambs, seven months old, were full-fed a finishing ration in individual pens to ascertain the relationships among ruminal development, rate of gain, feed consumption, and ruminal volatile fatty acids (VFA). Samples of ruminal contents were taken one hour after feed consumption and again after a five-hour fast for VFA analyses at three intervals during the 135-day study. Significant individual differences were observed among lambs with respect to VFA concentrations and molar percentages of acetate, propionate, and butyrate. The molar proportions of the various VFA were not significantly correlated to ruminal development or to rate of gain, but were significantly related to the immediate pattern of feed consumption. Acetate was positively and propionate negatively correlated to feed consumption in the nonfasted samples. Butyrate proportions increased with fasting in lambs that had a pattern of higher feed consumption, thus suggesting that individual variation in feed consumption by ruminants is associated with measurable physiologic events within the rumen.

V. FUTURE PLANS:

Sample and statistical analyses will be completed on the insulin tolerance study involving the milk-fed animals. If the results are not absolutely definitive, the experiment will be modified and repeated. Continued emphasis will be placed on the carbohydrate enzyme study which, in addition to the glucokinase and hexokinase enzymes, will also include others whose activities are known to be dependent upon insulin.

VI. PUBLICATIONS DURING THE YEAR:

Omar, E. M., J. C. Reagor, and H. O. Kunkel. 1964. Ruminal development and distribution of intraruminal volatile fatty acids in suckling lambs. J. Animal Sci. 24:729.

VII. PUBLICATIONS PLANNED:

Reagor, J. C. and H. O. Kunkel. Individuality of feed-lot lambs with respect to ruminal development, rate of gain, and volatile fatty acids.

Submitted by: H. O. Kunkel

I. PROJECT: Animal Science H-650, AHRD Line Project dl-22 (S-10)

The Improvement of Production and Desirability of Beef Through Breeding Methods

II. OBJECTIVES:

To estimate and further test by selection and breeding, genetic parameters including heritability, heterotic effect, and genetic correlations for:

- 1 - weaning weight
- 2 - postweaning feedlot and pasture gain
- 3 - gain during the summer months
- 4 - beef value of the carcass, including distribution of carcass weight among various cuts and muscle, fat, and bone
- 5 - eating desirability of the beef
- 6 - other characteristics as their possible importance becomes evident.

To test breeds and strains of unknown or unrecorded productivity.

To develop procedures and techniques adequate for practical application in:

- 1 - record keeping
- 2 - artificial insemination
- 3 - other areas involved in management that present an obvious need in a breeding program.

To determine factors influencing milk production of beef cows and its relation to growth rate and weaning weight of their calves by:

- 1 - developing reliable methods for accurate estimation of the milk production of beef cows under practical conditions.
- 2 - establishing the degree of variability in production and composition of milk among individual beef cows of different ages and sizes and among the several breeds and crosses.
- 3 - determining the influence of quantity and composition of milk consumed upon growth rate and weaning weight of beef calves.
- 4 - determining the influence of advancing stage of lactation and age upon milk production of the same beef cows maintained on pasture, as compared with similar cows fed a standard ration of silage and supplement in drylot.
- 5 - determining the influence of level of energy supplementation upon milk production of beef cows maintained on pasture and in the drylot.

III: PERSONNEL:

T. C. Cartwright, R. J. Cooper, W. E. Kruse, J. K. Riggs, and H. O. Hill.

IV. ACCOMPLISHMENTS DURING THE YEAR:

Since estimates of heritability, variance, genetic, and phenotypic correlations, and relative economic value cannot be determined for each separate population, appropriate average values are indicated for use in formulating efficient breeding plans. Independent estimates of heritability and correlations selected from the literature were weighted according to size of population represented and averaged for weaning weight and score, feedlot gain, and final feedlot weight and score. Using these averages and averages of recent estimates of variance, genetic and phenotypic variance-covariance matrices were constructed. Likely relative economic values were derived from information in the literature. All possible selection indexes were constructed for each of the several definitions of net merit considered logical. These definitions ranged from weaning weight alone to that involving weaning weight and score, and feedlot gain and score. For all definitions of net merit used, weaning score or final score contributed only slightly to relative efficiency. Final weight was the best single trait index. Relative emphasis of weaning weight and feedlot gain varied greatly with different definitions of net merit. Indexes including weaning weight and daily feedlot gain appear most useful, but they ranged from  $I = WW + 150 DFG$  to  $I = WW + 250 DFG$ , depending on emphasis given to weaning or over-all performance. A general dearth of published information on the relative economic values limits the validity of this study, although the estimates used are thought to be more adequate than most.

The effect of weight of dam on 180-day weights of 385 Hereford calves from 153 dams and weaning weights of 518 Angus calves from 250 dams was studied. The data on Angus were obtained from Cedar Hill Ranch, a privately owned herd at Midlothian, Texas. Hereford cows were weighed at calving and Angus cows at weaning. Least-squares analyses were conducted with weight of dam included as either a discrete variable (100 lb. intervals) or a continuous variable. Other factors included were sex, year of birth, season of birth, age of dam, and age of calf (Angus only). A linear relationship between calf weight and cow weight was observed in the Angus. Constants ranged from -29 to 39 pounds for 600-699 and 1400-1499 pound dams, respectively. A curvilinear relationship was observed in the Herefords. The constants ranged from -38 to 17 pounds for 600-699 and 1300-1399 pound dams, respectively. Constants for all cow weight groups between 900 and 1499 pounds ranged from 6 to 17 pounds. Average calf weight increased by 8.5 and 4.9 pounds per 100-pound increase in weight of the dam for Angus and Herefords, respectively, when weight of dam was included as a continuous variable. Simple correlations between 180-day calf weight and weights and measurements of their dams for 72 Hereford cows and calves were: cow weight, 0.34; heart girth, 0.33; hook width, 0.36; and wither height, back length, and rump length, 0.45. Multiple correlations of calf weight with measurements of cow size were 0.50 with wither height and back length, and 0.52 with all measurements (including weight).

Records from herds in Alabama, Florida, Georgia, Louisiana, North Carolina, South Carolina, and Texas were included in a cooperative S-10 study. Preliminary analyses included weight of cow, either when she calved or when her calf was weaned or both. Repeated yearly observations on individuals were included

in the 2475 weights at calving and the 3064 weights at weaning. Data were analyzed on both an individual location and pooled-location basis. The model for the pooled least-squares analysis following Henderson's Method II included location-year, breed within location-year, sire within breed, progeny within sire, age of dam, and previous parity, plus calving month for weight at calving. All sources of variation were statistically significant at the 0.05 level. The least-square constants indicated that cow weight increased with each year's increase in age up to nine years of age (the limit of these data), but the rate of increase decreased with age. Cows not parous the previous year weighed 56 pounds more at calving than parous cows and 21 pounds more at weaning. Fall-calving cows were heavier than spring-calving cows. The heritability estimate of cow weight at calving was 0.96 and at weaning was 0.74. The sire components of variance were probably overestimated due to repeated measures on individuals within sires. The major analyses planned will be completed by the end of the summer of 1965.

Results of least-squares analysis of 180-day calf weights at McGregor are given in table 1.

TABLE 1. Least-squares Constants and Averages for 180-Day Weight, in Pounds, for 1950 Through 1964 at the Livestock and Forage Research Center, McGregor, Texas

Breeding		No. Calves	Constant	180-Day weight	Breeding of calf*
Sire	Dam*				
--	--	3692		429	
Charbray	Charbray	68	61	490	Charbray
Charolais	1/2-3/4 Char-H	16	53	482	47, 72, & 73
SG	1/2RP-1/4H-1/4B	16	45	474	61
SG	1/2-3/4SG-RP-H-B	8	43	472	62 & 63
Charolais	3/4H-1/4B	18	41	470	10 & 86
Charolais	Charolais	45	38	468	Charolais
Charbray	H-B 1st Cross	58	27	456	66
Red Poll	H-B 1st Cross	21	27	456	14
Charolais	H-B 1st Cross	36	23	453	16
Charolais	1/2Char-1/4H-1/4B	35	23	452	67, 77 & 82
Charbray	3/4H-1/4B	21	20	448	76 & 81
SG	1/2-3/4SG-H-B	34	19	448	42 & 43
Brown Swiss	H-B 1st Cross	64	12	441	57
Hereford	H-B 1st Cross	157	7	437	3
SG	3/4SG-1/4H	71	6	435	33 & 34
SG	Red Poll	51	1	430	51
Hereford	Brahman	40	1	430	2
SG	H-B 1st Cross	63	0	429	13
H-B 1st Cross	H-B 1st Cross	33	-1	428	21
SG	1/2H-1/2 SG	112	-2	428	32
Charolais	Hereford	9	-2	427	15 & 26
Brahman	H-B 1st Cross	204	-3	426	4
SG	SG	105	-3	426	Santa Gertrudis
SG	1/2-3/4SG-RP	22	-6	424	52, 53 & 54
Hereford	3/4H-1/4B	46	-12	417	5

TABLE 1. Continued

Breeding		No. Calves	Constant	Av. 180-Day weight	Breeding of calf*
Sire	Dam*				
SG	Hereford	65	-25	404	11
H-B 1st Cross	Brahman	24	-28	401	7
Brahman	Hereford	675	-29	399	1
Brahman	3/4B-1/4H	97	-32	397	23
Brahman	7/8B-1/8H	39	-35	394	24 & 25
Red Poll	Hereford	19	-37	392	12
H-B 1st Cross	Hereford	54	-40	390	9
Brahman	Brahman	260	-61	368	Brahman (B)
Angus	Angus	106	-62	367	Angus
Hereford	Hereford	1000	-67	362	Hereford (H)

Sex

Bull	16
Heifer	-23
Steer	8

Age of Dam

2 year old	-42
3 year old	-18
4 and 5 year old	11
6 and 7 year old	12
8 and 9 year old	18
10 and 11 year old	21
12 years and older	-2

Months

November and December	16
January and February	11
March and April	1
May and June	-28

Year

1950	-15
1951	-82
1952	-9
1953	-10
1954	-8
1955	22
1956	43

TABLE 1. Continued

Age of dam	No.	Calves	Constant	Av. 180-day weight	Breeding of calf*
<u>Year, continued</u>					
1957				21	
1958				22	
1959				27	
1960				10	
1961				-1	
1962				23	
1963				-13	
1964				-30	

\*Breeding of dam varies slightly for some breeding types. For exact, complete breeding given under BREEDING OF CALF, see breed and cross code for key.

V. FUTURE PLANS:

Data collection and analysis will continue. More emphasis will be placed on determining the importance of mature weight and its relationship to production. Continued emphasis will be given to the relative importance of carcass weight per day of age and carcass composition. Evaluation of efficiency and maximum production will continue. Additional emphasis will be given to evaluating Charolais and Brown Swiss for beef production in breeding programs utilizing non-additive genetic variance.

VI. PUBLICATIONS DURING THE YEAR:

Cartwright, T. C., G. F. Ellis, Jr., W. E. Kruse and E. K. Crouch. 1965. Hybrid vigor in Brahman-Hereford crosses. Texas Agricultural Experiment Station, Technical Monograph No. 1.

Petty, R. R., Jr., T. C. Cartwright and R. J. Cooper. 1965. A theorectical comparison of selection indexes for beef cattle. J. Animal Sci. 24:281. (Abs.)

Tanner, J. E., R. J. Cooper and W. E. Kruse. 1965. Relationship between weaning weights of calves and weights and measurements of their dams. J. Animal Sci. 24:280. (Abs.)

Fitzhugh, H. A., Jr., T. C. Cartwright and R. S. Temple. 1965. Effects associated with beef cow weight. J. Animal Sci. 24:848. (Abs.)

Ellis, G. F., Jr., T. C. Cartwright and W. E. Kruse. 1965. Heterosis for birth weight in Brahman-Hereford crosses. J. Animal Sci. 24:93.

VII. PUBLICATIONS PLANNED:

Ellis, G. F., Jr., and T. C. Cartwright. Heterosis for weaning weight in Brahman-Hereford crosses.

Fitzhugh, H. A., Jr., T. C. Cartwright and R. S. Temple. Genetic and environmental effects associated with cow weight.

Petty, R. R., Jr., T. C. Cartwright and R. J. Cooper. Selection indexes for beef cattle.

Submitted by: T. C. Cartwright

I. PROJECT: S-1129 (S-10)

A Comparison of the Performance of Beef Cattle Selected by Four Different Criteria.

II. OBJECTIVES:

To compare the performance, as measured by weaning weight and grade, stocker gain and grade, feedlot gain and grade, and carcass characteristics of four beef cattle herds selected as follows:

- a. An "A" herd in which herd sires and replacement heifers are selected by giving equal emphasis to conformation and gaining ability.
- b. A "B" herd in which herd sires and replacement heifers are selected on gaining ability.
- c. A "C" herd in which herd sires and replacement heifers are selected by visual appraisal, using current show ring standards of confirmation.
- d. An "F" herd in which herd sires and replacement heifers are selected for low gaining ability.

To determine the relationships existing among the above-mentioned characteristics in beef cattle.

III. PERSONNEL:

George F. Ellis, Jr., James A. Carpenter, Jr., Ralph M. Durham and O. D. Butler

IV. ACCOMPLISHMENTS DURING THE YEAR:

Project S-1129 is continuing as a long-term breeding project. Strict selection was practiced in the past year and a large number of replacement heifers produced under the selection program were placed in the herds. If selection is effective, herd differences should become larger in subsequent years. A seven-year summary of adjusted weaning weights is shown in table 1.

TABLE 1. Seven-Year Summary of Weaning Weights  
(Adjusted to 205 days of age and for age of dam)\*

Year	A Herd		B Herd		C Herd		F Herd	
	Steers	Heifers	Steers	Heifers	Steers	Heifers	Steers	Heifers
1958	494	487	541	518	553	543	471	494
1959	522	488	528	523	571	526	500	513
1960	480	451	514	511	508	510	507	489
1961	529	522	497	526	545	518	490	508
1962	502	495	510	512	539	529	496	490
1963	471	437	502	482	483	445	443	420
1964	453	408	486	432	436	414	407	423

\*1964 weights adjusted for month of birth also.

V. FUTURE PLANS

Project S-1129 will continue as outlined. In addition, previous weights will be readjusted using correction factors determined by least-squares analysis on first seven years' data.

VI. PUBLICATIONS DURING THE YEAR:

None

VII. PUBLICATIONS PLANNED:

None

Submitted by: G. F. Ellis, Jr.

I. PROJECT: S-1547

Genetics of Qualitative Characters in Beef Cattle

II. OBJECTIVES:

To initiate and develop a laboratory facility to detect and gather data on immunogenetic markers of beef cattle.

To estimate gene frequency and genetic equilibrium of immunogenetic markers in Texas beef cattle populations.

To devise simplified techniques of parentage determination by use of blood types for multiple-sire herds.

To determine correlated responses among reproduction, production, and carcass characters associated with blood types.

To catalog qualitative characters, standardize terms and symbols, and attempt to identify linkage groups.

To cooperate with other Stations in the exchange of data and genetic material and offer them blood typing service.

To initiate new lines of research dealing with the basic properties of immunogenetics and the applications of these properties to animal breeding.

III. PERSONNEL:

D. F. Weseli, T. C. Cartwright, and R. J. Cooper

IV. ACCOMPLISHMENTS DURING THE YEAR:

The laboratory facility for blood typing cattle is now under development. Work on the physical facilities was started during January, 1965, and is expected to be finished in June, 1965. A rabbit colony, which will serve as the source of typing complement and immunization recipients has been started.

V. FUTURE PLANS:

Immunizations for the production of typing reagents have been planned. These will be started immediately on completion of the laboratory remodeling. A group of 105 cattle of several breeds have been blood typed by the University of California and will serve as immunization donors, recipients, and as a source of blood for absorptions and standardization of reagents.

VI. PUBLICATIONS DURING THE YEAR:

None

VII. PUBLICATIONS PLANNED:

None

Submitted by: D. F. Weseli

## CATTLE BREED AND CROSS CODE

<u>Breed or Cross</u>	<u>Dam Breeding</u>	<u>Sire Breeding</u>	<u>Progeny Breeding</u>
A	Angus	Angus	Angus
B	Brahman	Brahman	Brahman
BS	Brown Swiss	Brown Swiss	Brown Swiss
C	Charbray	Charbray or Charolais	$\frac{3}{4}$ , $\frac{7}{8}$ L - $\frac{1}{4}$ , $\frac{1}{8}$ B
G	Santa Gertrudis	Santa Gertrudis	Santa Gertrudis
H	Hereford	Hereford	Hereford
L	Charolais	Charolais	Charolais
R	Red Poll	Red Poll	Red Poll
1x	Hereford	Brahman	$\frac{1}{2}$ H - $\frac{1}{2}$ B
2x	Brahman	Hereford	$\frac{1}{2}$ B - $\frac{1}{2}$ H
3x	1x & 2x	Hereford	$\frac{3}{4}$ H - $\frac{1}{4}$ B
4x	1x	Brahman	$\frac{3}{4}$ B - $\frac{1}{4}$ H
5x	3x & 9x	Hereford	$\frac{7}{8}$ H - $\frac{1}{8}$ B
7x	Brahman	1x & 2x	$\frac{3}{4}$ B - $\frac{1}{4}$ H
9x	Hereford	1x & 2x	$\frac{3}{4}$ H - $\frac{1}{4}$ B
10x	3x, 5x, & 9x	Charolais	$\frac{5}{8}$ L - $\frac{3}{8}$ H
11x	Hereford	Santa Gertrudis	$\frac{1}{2}$ H - $\frac{1}{2}$ G
12x	Hereford	Red Poll	$\frac{1}{2}$ H - $\frac{1}{2}$ R
13x	1x	Santa Gertrudis	$\frac{1}{2}$ G - $\frac{1}{4}$ H - $\frac{1}{4}$ B
14x	1x	Red Poll	$\frac{1}{2}$ RP - $\frac{1}{4}$ H - $\frac{1}{4}$ B
15x	Hereford	Charolais	$\frac{1}{2}$ H - $\frac{1}{2}$ L
16x	1x & 2x	Charolais	$\frac{1}{2}$ L - $\frac{1}{2}$ H - $\frac{1}{4}$ B
21x	1x	1x & 2x	$\frac{1}{2}$ H - $\frac{1}{2}$ B (inter se)
23x	4x	Brahman	$\frac{7}{8}$ B - $\frac{1}{8}$ H
24x	23x	Brahman	$\frac{15}{16}$ B - $\frac{1}{16}$ H
25x	24x	Brahman	$\frac{31}{32}$ B - $\frac{1}{32}$ H
26x	Hereford	Charbray	$\frac{1}{2}$ H - $\frac{7}{16}$ L - $\frac{1}{16}$ B
32x	11x	Santa Gertrudis	$\frac{3}{4}$ G - $\frac{1}{4}$ H
33x	32x	Santa Gertrudis	$\frac{7}{8}$ G - $\frac{1}{8}$ H
34x	33x	Santa Gertrudis	$\frac{15}{16}$ G - $\frac{1}{16}$ H
36x	Brahman	Charbray	$\frac{9}{16}$ B - $\frac{7}{16}$ L
37x	36x	Charolais	$\frac{3}{4}$ L - $\frac{1}{4}$ B
38x	37x	Charolais	$\frac{7}{8}$ L - $\frac{1}{8}$ B
39x	38x	Charolais	$\frac{15}{16}$ L - $\frac{1}{16}$ B
42x	13x	Santa Gertrudis	$\frac{3}{4}$ G - $\frac{1}{8}$ H - $\frac{1}{8}$ B
43x	42x	Santa Gertrudis	$\frac{7}{8}$ G - $\frac{1}{16}$ H - $\frac{1}{16}$ B
44x	43x	Santa Gertrudis	$\frac{15}{16}$ G - $\frac{1}{32}$ H - $\frac{1}{32}$ B
47x	10x	Charolais	$\frac{13}{16}$ L - $\frac{3}{16}$ H
51x	Red Poll	Santa Gertrudis	$\frac{1}{2}$ R - $\frac{1}{2}$ G
52x	51x	Santa Gertrudis	$\frac{3}{4}$ G - $\frac{1}{4}$ R
53x	52x	Santa Gertrudis	$\frac{7}{8}$ G - $\frac{1}{8}$ R
54x	53x	Santa Gertrudis	$\frac{15}{16}$ G - $\frac{1}{16}$ R
57x	1x	Brown Swiss	$\frac{1}{2}$ BS - $\frac{1}{4}$ H - $\frac{1}{4}$ B
58x	H	Brown Swiss	$\frac{1}{2}$ BS - $\frac{1}{2}$ H
61x	14x	Santa Gertrudis	$\frac{1}{2}$ G - $\frac{1}{4}$ R - $\frac{1}{8}$ H - $\frac{1}{8}$ B

CATTLE BREED AND CROSS CODE, CONTINUED.

<u>Breed or Cross</u>	<u>Dam Breeding</u>	<u>Sire Breeding</u>	<u>Progeny Breeding</u>
62x	61x	Santa Gertrudis	3/4 G - 1/8 R - 1/16 H - 1/16 B
63x	62x	Santa Gertrudis	7/8 G - 1/16 R - 1/32 H - 1/32 B
64x	63x	Santa Gertrudis	15/16 G - 1/32 R - 1/64 H - 1/64 B
66x	1x & 2x	Charbray	7/16 L - 1/4 H - 5/16 B
67x	66x	Charolais	3/4 L - 1/8 H - 1/8 B
72x	15x	Charolais	3/4 L - 1/4 H
73x	72x	Charolais	7/8 L - 1/8 H
76x	3x, 5x, & 9x	Charbray	7/16 L - 3/8 H - 3/16 B
77x	76x	Charolais	3/4 L - 3/16 H - 1/16 B
81x	16x	Charbray	15/32 L - 1/4 H - 9/32 B
82x	16x	Charolais	3/4 L - 1/8 H - 1/8 B
86x	13x	Charbray	7/16 L - 1/4 G - 1/8 H - 3/16 B

## FORM I

## PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Texas

Location	McGregor	McGregor	McGregor	McGregor	McGregor
Breed of sire	H	H	A	B	L & C
Breed of dam	H	H	A	B	L & C
Line or group	Purebred	Grade	Purebred	Purebred	Purebred
Percent used in project	100	100	100	100	100
Inventory as of July 1, 1965	Cows 2 years and over	107	88	29	31
	Yearling heifers	14	16	5	4
	Bulls and steers under 1 year	34	24	13	8
	Heifers under 1 year	48	31	12	8
	Bulls over 1 year	17		2	3
	Steers over 1 year		9	4	1
	Percent pregnant <sup>1</sup>	86		92	68
Repro. perf.	Calf survival percent <sup>2</sup>	91		86	81
	Adj. ADG <sup>3</sup>	1.92		2.00	1.97
Wean. perf.	Av. type sc.	0	0	0	0
	No. of bulls	18		7	8
Postweaning performance	No. of heifers	9/42 <sup>a</sup>		2/9 <sup>a</sup>	1/6 <sup>a</sup>
	No. of steers	39		6	1
	No. of bulls				
Slaughtered	No. of heifers	8			
	No. of steers	33		4	1

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:
  - a. The first number is feedlot; the second is grazing.

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Texas

Location	McGregor	McGregor	McGregor	McGregor	McGregor
Breed of sire	BS	G	B	L	G
Breed of dam	BS	G	H	5x	H
Line or group	Purebred	Purebred	Crossbred	Crossbred	Crossbred
Percent used in project					
Inventory as of July 1, 1965	Cows 2 years and over		13	32	1
	Yearling heifers				
	Bulls and steers under 1 year				
	Heifers under 1 year				
	Bulls over 1 year	3	2		
	Steers over 1 year				
Repro. perf.	Percent pregnant <sup>1</sup>		88	80	100
	Calf survival percent <sup>2</sup>		80	81	100
Wean. perf.	Adj. ADG <sup>3</sup>		2.48		1.73
	Av. type sc.	0	0	0	0
Postweaning performance	No. of bulls		1		
	No. of heifers				
	No. of steers				
Slaughtered	No. of bulls				
	No. of heifers				
	No. of steers				

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DAT, S-10 HERDS - 1964-1965

State Texas

Location	McGregor	McGregor	McGregor	McGregor	McGregor
Breed of sire	L	L	B	G	G
Breed of dam	H	1x	4x	11x	32x
Line or group	Crossbred	Crossbred	Crossbred	Crossbred	Crossbred
Percent used in project					
Inventory as of July 1, 1965	Cows 2 years and over	3	9	13	31
	Yearling heifers			3	2
	Bulls and steers under 1 year	9	10		6
	Heifers under 1 year	1	8		12
	Bulls over 1 year				
	Steers over 1 year		4	2	
	Percent pregnant <sup>1</sup>	27	78	82	64
Repro. perf.	Calf survival percent <sup>2</sup>	100	100	71	90
	Adj. ADG <sup>3</sup>		2.62		2.44
Wean. perf.	Av. type sc.	0	0	0	0
Postweaning performance	No. of bulls				
	No. of heifers		1/3		-/3
	No. of steers		6		1
Slaughtered	No. of bulls				
	No. of heifers				
	No. of steers		5		1

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Texas

Location	McGregor	McGregor	McGregor	McGregor	McGregor
Breed of sire	C	G	G	G	L
Breed of dam	B	33x	13x	42x	10x
Line or group	Crossbred	Crossbred	Crossbred	Crossbred	Crossbred
Percent used in project					
Inventory as of July 1, 1965	Cows 2 years and over	1	5	1	2
	Yearling heifers		1	2	1
	Bulls and steers under 1 year		2		
	Heifers under 1 year		3	2	
	Bulls over 1 year				
	Steers over 1 year				
Repro. perf.	Percent pregnant <sup>1</sup>	100	0	40	100
	Calf survival percent	100		100	100
Wean. perf.	Adj. ADG <sup>3</sup>	2.17			2.43
	Av. type sc.				
Postweaning performance	No. of bulls				
	No. of heifers		1/1	-/2	-/1
	No. of steers			3	1
Slaughtered	No. of bulls				
	No. of heifers		1		
	No. of steers			1	1

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

FORM I

PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Texas

Location	McGregor	McGregor	McGregor	McGregor	McGregor
Breed of sire	G	G	G	BS	BS
Breed of dam	43x	R	51x	1x	H
Line or group <sup>1</sup>	Crossbred	Crossbred	Crossbred	Crossbred	Crossbred
Percent used in project					
Inventory as of July 1, 1965	Cows 2 years and over		3	9	18
	Yearling heifers	1			13
	Bulls and steers under 1 year			2	5
	Heifers under 1 year	1			5
	Bulls over 1 year				
	Steers over 1 year			1	7
Repro. perf.	Percent pregnant <sup>1</sup>	0	100	22	56
	Calf survival percent <sup>2</sup>		33	40	60
Wean. perf.	Adj. ADG <sup>3</sup>			2.78	2.43
	Av. type sc.				
Postweaning performance	No. of bulls				
	No. of heifers	-/1			-/14
	No. of steers			1	9
Slaughtered	No. of bulls				
	No. of heifers				
	No. of steers			1	9

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive) Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Texas

Location	McGregor	McGregor	McGregor	McGregor	McGregor
Breed of sire	G	G	C	L	L
Breed of dam	61x	62x	1x	66x	15x
Line or group	Crossbred	Crossbred	Crossbred	Crossbred	Crossbred
Percent used in project					
Inventory as of July 1, 1965	Cows 2 years and over	4	3	3	1
	Yearling heifers		2		1
	Bulls and steers under 1 year		1	1	1
	Heifers under 1 year		1	1	1
	Bulls over 1 year				
	Steers over 1 year				
Repro. perf.	Percent pregnant <sup>1</sup>	50	100	0	67
	Calf survival percent <sup>2</sup>	0	67		100
Wean. perf.	Adj. ADG <sup>3</sup>		2.39		2.52
	Av. type sc.				
Postweaning performance	No. of bulls				
	No. of heifers	-/2	-/2		-/1
	No. of steers		2	2	
Slaughtered	No. of bulls				
	No. of heifers				
	No. of steers		2	2	

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

## FORM I

## PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Texas

Location	McGregor	McGregor	McGregor	McGregor	McGregor
Breed of sire	L	L	L	B	B
Breed of dam	5x	76x	16x	23x	24x
Line or group	Crossbred	Crossbred	Crossbred	Crossbred	Crossbred
Percent used in project					
Inventory as of July 1, 1965	Cows 2 years and over	1	1	5	8
	Yearling heifers		1	2	3
	Bulls and steers under 1 year			3	9
	Heifers under 1 year	1	2	5	3
	Bulls over 1 year				
	Steers over 1 year				
Repro. perf.	Percent pregnant <sup>1</sup>	100	50	78	71
	Calf survival percent <sup>2</sup>	100	100	100	57
Wean. perf.	Adj. ADG <sup>3</sup>	2.29	2.17	2.29	1.99
	Av. type sc.				1.63
Postweaning Performance	No. of bulls				
	No. of heifers		-/1	-/3	-/4
	No. of steers		1	5	6
Slaughtered	No. of bulls				
	No. of heifers				
	No. of steers		1	5	6

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive).  
Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Texas

Location	McGregor	McGregor	McGregor	McGregor	McGregor
Breed of sire	L	L	L	L	H
Breed of dam	67x	72x	77x	82x	58x
Line or group	Crossbred	Crossbred	Crossbred	Crossbred	Crossbred
Percent used in project					
Inventory as of July 1, 1965	Cows 2 years and over				
	Yearling heifers				
	Bulls and steers under 1 year	1			2
	Heifers under 1 year		1	1	
	Bulls over 1 year				
	Steers over 1 year				
Repro. perf.	Percent pregnant <sup>1</sup>	67	100	100	57
	Calf survival percent				
Wean. perf.	Adj. ADG <sup>3</sup>		1.83		2.70
	Av. type sc.			.	
Postweaning performance	No. of bulls				
	No. of heifers				-/1
	No. of steers		1		1
Slaughtered	No. of bulls				
	No. of heifers				
	No. of steers		1		1

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive).  
Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Texas

Location	McGregor	McGregor	McGregor	McGregor	McGregor
Breed of sire	G	G	H	BS	G
Breed of dam	52x	53x	57x	57x	63x
Line or group	Crossbred	Crossbred	Crossbred	Crossbred	Crossbred
Percent used in project					
Inventory as of July 1, 1965	Cows 2 years and over				
	Yearling heifers				
	Bulls and steers under 1 year	2	1	3	3
	Heifers under 1 year	2		1	4
	Bulls over 1 year				
	Steers over 1 year				
Repro. perf.	Percent pregnant <sup>1</sup>				
	Calf survival percent <sup>2</sup>				
Wean. perf.	Adj. ADG <sup>3</sup>	2.13			
	Av. type sc.				
Postweaning performance	No. of bulls				
	No. of heifers	-/1			
	No. of steers	1			
Slaughtered	No. of bulls				
	No. of heifers				
	No. of steers	1			

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Texas

Location	McGregor	McGregor	McGregor	McGregor	McGregor
Breed of sire	L	G	L	G	L
Breed of dam	52x & 33x	34x	36x	44x	47x
Line or group	Crossbred	Crossbred	Crossbred	Crossbred	Crossbred
Percent used in project					
Inventory as of July 1, 1965	Cows 2 years and over				
	Yearling heifers				
	Bulls and steers under 1 year	1	1	1	
	Heifers under 1 year	3		1	1
	Bulls over 1 year				
	Steers over 1 year				
Repro. perf.	Percent pregnant <sup>1</sup>				
	Calf survival percent <sup>2</sup>				
Wean. perf.	Adj. ADG <sup>3</sup>				1.81
	Av. type sc.				
Postweaning performance	No. of bulls				
	No. of heifers				
	No. of steers				1
Slaughtered	No. of bulls				
	No. of heifers				
	No. of steers				1

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

VIRGINIA POLYTECHNIC INSTITUTE  
Agricultural Experiment Station

I. PROJECT: S-031-8 (S-10)

Evaluation of the Effectiveness of Selection for Economic Traits in Beef Cattle

II. OBJECTIVES:

To obtain estimates of genetic parameters from field data to include:

- a. heritability and repeatability of traits,
- b. phenotypic and genetic correlations, and
- c. construction of selection indexes.

To study the effects of location on performance records and on adjustment factors needed.

To determine the minimum gains required to obtain measurable genetic difference among animals.

To study the factors influencing performance and sale price of ROP bulls.

To evaluate the effectiveness of selection on the improvement of beef cattle under farm conditions.

III. PERSONNEL:

T. J. Marlowe, R. R. Schalles, G. W. Morrow, D. G. Vogt, and T. N. Meacham

IV. ACCOMPLISHMENTS DURING THE YEAR:

Objective five of the revised project, approved January 1, 1964, calls for comparing the performance of contemporary progenies produced in the same herd and year from two groups of Culpeper ROP bulls with birth dates differing by five years. To accomplish this objective, semen collected from 12 Hereford bulls tested in 1959-60, and 12 tested in 1964-65 was processed and frozen. This semen is being used to breed 110 commercial Hereford cows each year for three years. Extra semen was collected from the older bulls and stored for comparison with bulls from the 1969-70 test. These contemporary comparisons of progeny from sires selected from different birth years are expected to yield unbiased estimates of half of the absolute genetic progress.

Manuscripts were completed on the study of non-genetic factors that influence preweaning performance and for heritability estimates of, and phenotypic and genetic correlation between, preweaning gains and weaning grade. They were submitted and accepted for publication in the Journal of Animal Science (see under publications below).

V. FUTURE PLANS:

Artificial insemination of approximately 110 Herefords with semen from ROP bulls differing in age by five years will continue until sufficient progeny are obtained for statistical comparisons to determine the amount of genetic progress obtained. Effort will be made to work out a similar arrangement for the Angus breed.

Factors that influence the performance of bulls on ROP test and factors that influence sale price of ROP bulls will be studied.

VI. PUBLICATIONS DURING THE YEAR:

Marlowe, T. J. 1964. Evidence of selection for the snorter dwarf gene in cattle. J. Animal Sci. 23:454.

Marlowe, T. J. 1964. Influences of various factors on the sale price of purebred Hereford calves in Southwest Virginia. Va. Jour. Sci. 15:168.

Marlowe, T. J. 1964. Graduate programs in Animal Science. V.P.I. Block and Bridle Annual. pp. 63-65.

Marlowe, T. J., C. C. Mast and R. R. Schalles, 1965. Some non-genetic influences on calf performance. J. Animal Sci. 24:494.

Marlowe, T. J., C. C. Mast and D. M. Sheehan, 1964. Beef cattle parameters from field data: II. Two methods of estimating age of cow effect on calf performance. J. Animal Sci. 23:851 (Abs.).

Marlowe, T. J. and D. W. Vogt, 1964. The heritability of growth and conformation in beef calves. Va. Jour. Sci. 15:258 (Abs.).

Marlowe, T. J. and D. W. Vogt, 1965. Heritabilities, phenotypic correlations and genetic correlations involving preweaning gain and weaning grade of beef calves. J. Animal Sci. 24:502.

I. PROJECT: Hatch 93901,

Heterosis from Crosses among British Breeds of Beef Cattle.

II. OBJECTIVES:

To measure heterosis obtained from crosses among the Aberdeen-Angus, Hereford, and Beef Shorthorn breeds, as shown by growth rate, fattening ability, and carcass quality.

To measure productive ability of crossbred versus purebred dams.

III. PERSONNEL:

J. A. Gaines, W. H. McClure, R. C. Carter, and J. S. Copenhaver

IV. ACCOMPLISHMENTS DURING THE YEAR:

The second calf crop in phase two was born approximately January to April of 1964, and weaned in October 1964. After an adjustment period (16 days for the heifers and 30 days for the steers) they were put on full feed in groups in dry lot on fattening rations. The heifers will be fed 182 days, and the steers 196 days. Table 1 contains a summary to weaning for the 1964 calves.

TABLE 1. Cow Productivity and Calf Performance to Weaning,  
1964 Calf Crop

	Purebred dams	Crossbred dams
No. cows bred	60	60
No. cows calving, and percent	55 (91.7)	58 (96.7)
Calves weaned, and percent	52 (86.7)	56 (93.3)
Average birth weight, pounds	74.4	75.6
Average weaning weight-steers, pounds	417	453
Average weaning weight-heifers, pounds	391	434
Average weaning grade, S-10 scores	11.4	12.5

The first calf crop in phase two was slaughtered during 1964. Table 2 contains a summary.

TABLE 2. Weaning Weights, Feedlot Daily Gain, Grades and Yields,  
1963 Calf Crop

Type of cow and mating	No. of calves	Weaning weights	Daily gain	Slaughter Grade <sup>1</sup>	Carcass Grade <sup>1</sup>	Dressing percent
<u>Steers</u>						
Purebred Dams						
3 Breed Cross	18	404	2.18	12.2	12.5	60.8
Backcross	13	394	2.09	11.8	12.7	60.7
Average	31	400	2.14	12.0	12.6	60.8
Crossbred Dams						
3 Breed Cross	15	428	2.22	12.0	11.5	59.8
Backcross	13	427	2.23	12.3	11.4	59.4
Average	28	428	2.23	12.2	11.5	59.6
<u>Heifers</u>						
Purebred Dams						
3 Breed Cross	13	395	2.14	12.8	12.2	59.9
Backcross	13	407	2.14	11.2	12.8	59.6
Average	26	401	2.14	11.5	12.5	59.7
Crossbred Dams						
3 Breed Cross	13	411	2.26	11.6	12.3	58.8
Backcross	11	410	2.29	11.8	12.5	59.0
Average	24	410	2.28	11.7	12.4	58.9

<sup>1</sup>Grade Code: 11, Good Plus; 12, Choice Minus; 13, Choice

V. FUTURE PLANS:

Phase of this project will be continued as approved.

VI. PUBLICATIONS DURING THE YEAR:

Richardson, Gary E. 1965. Heterosis in carcass traits from crosses among British breeds of beef cattle. M.S. Thesis, Library, Virginia Polytechnic Institute, Blacksburg, Va.

VII. PUBLICATIONS PLANNED:

Gaines, J. A., W. H. McClure, D. W. Vogt, R. C. Carter and C. M. Kincaid. 1965. Heterosis from crosses among British breeds of beef cattle: fertility and calf performance to weaning. *J. Animal Sci.* (in press).

An abstract has been submitted for presentation at the Mendel Centennial Celebration.

An abstract has been submitted to the J. Animal Sci. for presentation at the 1965 annual meetings.

Submitted by: J. A. Gaines

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Virginia

Location	Steeles Tavern	Steeles Tavern	Steeles Tavern	Steeles Tavern	Steeles Tavern
Breed of sire	Angus	Hereford	Shorthorn	Angus x Hereford	Angus x Shorthorn
Breed of dam*	Cross	Cross	Cross	Purebred	Purebred
Line or group	Cross	Cross	Cross	Cross	Cross
Percent used in project	100	100	100	100	100
Inventory as of July 1, 1965	Cows 2 years and over	20	20	20	20
	Yearling heifers	0	0	0	0
	Bulls and steers under 1 year	15	11	11	13
	Heifers under 1 year	5	8	6	6
	Bulls over 1 year	2	2	2	2
	Steers over 1 year	0	0	0	0
	Percent pregnant <sup>1</sup>	100.0	100.0	90.0	95.0
Repro. perf.	Calf survival percent <sup>2</sup>	95.0	95.0	88.9	94.7
	Adj. ADG <sup>3</sup>	1.56	1.69	1.74	1.56
Wean. perf.	Av. type sc.	11.5	12.7	12.5	12.3
	No. of bulls	0	0	0	0
Postweaning performance	No. of heifers	5	8	6	7
	No. of steers	15	11	11	13
	No. of bulls	0	0	0	0
Slaughtered	No. of heifers	5	8	6	7
	No. of steers	15	11	11	13

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Include adjustments:

\*Crossbred dam included AxH, AxSh, and HxSh.

Purebred dams were Angus, Hereford, and Shorthorn.

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Virginia

Location	Steeles Tavern			
Breed of sire	Hereford x Shorthorn			
Breed of dam*	Purebred			
Line or group	Cross			
Percent used in project	100			
Inventory as of July 1, 1965	Cows 2 years and over	20		
	Yearling heifers	0		
	Bulls and steers under 1 year	9		
	Heifers under 1 year	5		
	Bulls over 1 year	2		
	Steers over 1 year	0		
Repro. perf.	Percent pregnant <sup>1</sup>	80.0		
	Calf survival percent <sup>2</sup>	87.5		
Wean. perf.	Adj. ADG <sup>3</sup>	1.54		
	Av. type sc.	10.4		
Postweaning performance	No. of bulls	0		
	No. of heifers	5		
	No. of steers	9		
Slaughtered	No. of bulls	0		
	No. of heifers	5		
	No. of steers	9		

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments:

\*Crossbred dam included AxH, AxSh, and HxSh.

Purebred dams were Angus, Hereford, and Shorthorn.

BEEF CATTLE RESEARCH STATION  
Front Royal, Virginia

I. PROJECT: AH 150.16, AH Line Project dl-4 (S-10)

The Improvement of Beef Cattle for Virginia Through Breeding Methods

II. OBJECTIVES:

Beef cattle research projects are conducted with three breeds of cattle (Angus, Hereford, and Shorthorn) and are associated with problems relating to the improvement of beef cattle for Virginia through breeding methods.

The objectives of the investigation are as follows:

To estimate the progress to be expected from mass selection as compared with family selection in the improvement of beef cattle.

To evaluate selection criteria and procedures and develop more precise and effective measures of quality and performance in beef cattle.

To simplify methods of progeny or sib testing whereby breeding cattle can be evaluated at comparatively young ages.

The long-term breeding program for the work at Front Royal may be roughly sub-divided into five phases, each of which has some direct bearing on the main objectives stated above:

(1) Test from weaning to yearling age those bull calves which appear to be herd-sire prospects on the basis of their pre-weaning performance.

(2) Progeny test as yearlings those bulls with favorable records from Phase 1.

(3) Choose as foundation sires those bulls with good records from Phases 1 and 2. Obtain 32 daughters by each foundation sire and out of unrelated cows.

(4) Allot 32 daughters from each foundation sire as follows: 16 are placed back with their sire to form an inbred line; 8 become a part of a growth herd where selection emphasis is on growth; and 8 become part of a type herd where selection emphasis is on type. For each breeding plan, measure the progress in terms of changes in growth rate and conformation. Compare the actual results with those expected from theoretical consideration.

(5) Test inbred lines for combining ability and outcross performance.

III. PERSONNEL:

B. M. Priode, K. P. Bovard, R. C. Carter, E. J. Warwick, and R. S. Temple

IV. ACCOMPLISHMENTS DURING THE YEAR:

1. Scope and nature of work.

The scope and nature of the project have remained essentially unchanged since its inception. Calves from inbred lines are now relatively more highly inbred than in earlier years; and, among the 12 foundation sires from which the basic females descended, only two Herefords remain in service. Mild inbreeding (less than 10 percent) has occurred in most selection lines.

Top-cross testing of Shorthorn inbred and selection lines has been initiated in a herd of about 120 grade Shorthorn cows maintained at the Blacksburg station.

2. Research results.

a. Dwarfism. A crossbred Snorter, No. 4703, was born April 19, 1964, proving her dam, No. 253 A-1, a carrier. This cow is the double great granddam of calf No. 3243 A-1, the 36 percent inbred Snorter dwarf born in 1963. The cow was bred artificially to a Hereford Snorter dwarf bull in 1963. Radiographs of one stillborn and 21 living calves were obtained during calving season in 1964. X-ray findings are shown in table 1 by kind of data, sex, and subjective film score, according to the scale used by the Iowa workers in the middle 1950's. On that scale, A was dwarf, C believed clean (homozygous normal), and B was predicted carrier (heterozygous normal), with  $B_2$  being only slightly abnormal,  $B_8$  approaching the dwarf appearance, and intermediate conditions expressed accordingly.

TABLE 1. Lateral Lumbar X-ray Results in Study  
of Dwarfism in A-1, 1964

Kind of data*	Sex	C	$B_2$	$B_3$	$B_4$	A	Total
Experimental	F		1	7			8**
	M		3		2		5..
Test	F	2	1			1	4
	M	1	2	2			5
All calves		3	7	9	2	1	22

\* Data - all A-1 calves called "experimental"; all others including crossbred dwarf No. 4703, called "test."

\*\* Not including No. 4107 FA-1, stillborn.

b. Heifers branded. In November, 107 yearling heifers were branded with 4 or 6 inch irons, and treated three ways after branding. The post-branding treatments included (1) control, i.e., no treatment, (2) scarlet oil, and (3) salad oil. The latter two treatments were applied to determine their possible effects upon normal healing processes. Healing condition of the brands was subjectively evaluated 27 days after branding. Size of the branding iron made little difference in the healing condition. Brands which seemed to heal best were those of control cattle. Application of either scarlet oil or salad oil apparently interfered with normal healing processes more than it helped by softening early scab growth. Angus were evidently burned more than Hereford and Shorthorn heifers, as shown in tables 2 and 3.

TABLE 2. Healing "Scores," Yearling Heifer Brands, 27 Days After Branding<sup>1</sup>

Size of iron	Treatment			
	Control	Red oil	White oil	Av.
4 inch	1.1	2.3	2.2	1.9
6 inch	1.4	2.3	1.8	1.8
<u>Breed</u>				
Angus	1.4	2.7	2.3	2.2
Hereford	1.2	2.2	1.6	1.7
Shorthorn	1.0	2.0	2.0	1.7
All	1.2	2.3	1.9	1.8

<sup>1</sup>Zero indicates no bleeding, healing optimum; four indicates moderate bleeding, thick scabby condition.

TABLE 3. Analysis of Variance, Brand Healing Scores

Source of variation	df	SS	M.S.	F
Breeds	2	5.8	2.92	5.1**
Size of brands	1	.2	.20	< 1.0
Treatments	2	22.1	11.07	19.2**
Error	101	58.1	.58	
Total	106	86.3		

\*\* P < .01

V. FUTURE PLANS:

A study of heptachlor residues in steers will be started in May 1965.

Plans are being made to begin a cooperative project of testcrossing to evaluate the four inbred and two single-trait selection lines in Angus.

Twelve inbred cows from each line will be used in a limited diallel test of two Angus, two Hereford, and two Shorthorn inbred lines in 1965.

VI. PUBLICATIONS DURING THE YEAR:

Bovard, K. P. 1964. Resume' of inbred and selection lines at Front Royal. Mimeograph of paper presented at Regional S-10 Beef Cattle Breeding meetings at Starksville, Mississippi, June 1964. S-10 Annual Report 1963-64, p. 38.

Bovard, K. P. and B. M. Priode. 1964. Various measures of daily gains of beef calves through postweaning tests. Va. J. Science.n.s. 15:251 (Abs.)

Harvey, W. R., K. P. Bovard and C. S. Givens. 1964. Progeny testing for a simple recessive. J. Animal Sci. 23 :849. (Abs.)

VII. PUBLICATIONS PLANNED:

"Summer gains and fall weights of beef cows in 1964 as affected by pregnancy status, lactation status, age and inbreeding" by K. P. Bovard and B. M. Priode, planned for presentation at the Virginia Academy of Science meeting in 1965.

"Snorter dwarfism in an Angus inbred line" by K. P. Bovard and B. M. Priode, planned for journal publication in 1965.

Submitted by: B. M. Priode and  
K. P. Bovard

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Virginia

Location	Front Royal	Front Royal	Front Royal	Front Royal	Front Royal
Breed of sire	Angus	Angus	Angus	Angus	Angus
Breed of dam	Angus	Angus	Angus	Angus	Angus
Line or group	A1	A2	A3	A4	A7
Percent used in project	100	100	100	100	100
Inventory as of July 1, 1965	Cows 2 years and over	16	23	18	19
	Yearling heifers	7	6	8	1
	Bulls and steers under 1 year <sup>a</sup>	9	10	7	7
	Heifers under 1 year <sup>a</sup>	6	7	3	2
	Bulls over 1 year	3	3	2	3
	Steers over 1 year	-	-	-	-
Repro. perf.	Percent pregnant <sup>1</sup>	83	78	81	68
	Calf survival percent <sup>2</sup>	87	100	100	60
Wean. perf.	Adj. ADG <sup>3</sup>	2.09	1.82	1.77	1.92
	Av. type sc.	11.8	12.2	11.3	11.7
Postweaning performance	No. of bulls	1	1	1	1
	No. of heifers	7	6	8	1
	No. of steers	3	3	2	3
Slaughtered	No. of bulls				
	No. of heifers				
	No. of steers	3	3	2	3

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments: age of dam, season of birth, sex, creep vs. no creep.

a. Additional calves expected between 5/1/65 and 7/1/65 have been estimated and added to the known inventory.

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Virginia

Location	Front Royal	Front Royal	Front Royal	Front Royal
Breed of sire	Angus	Angus	Hereford	Hereford
Breed of dam	Angus	Angus	Hereford	Hereford
Line or group	A8	A9	H2	H3
Percent used in project	100	100	100	100
Inventory as of July 1, 1965	Cows 2 years and over	33	17	17
	Yearling heifers	9	8	6
	Bulls and steers under 1 year <sup>a</sup>	15	7	7
	Heifers under 1 year <sup>a</sup>	12	5	8
	Bulls over 1 year	3	1	1
	Steers over 1 year			
Repro. perf.	Percent pregnant <sup>1</sup>	100	93	65
	Calf survival percent <sup>2</sup>	92	100	100
Wean. perf.	Adj. ADG <sup>3</sup>	1.94	1.42	1.56
	Av. type sc.	12.0	10.8	9.9
Postweaning performance	No. of bulls	2	1	1
	No. of heifers	9	8	6
	No. of steers	3	2	2
Slaughtered	No. of bulls			
	No. of heifers			
	No. of steers	3	2	2

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments: age of dam, season of birth, sex. creep vs. no creep.

a. Additional calves expected between 5/1/65 and 7/1/65 have been estimated and added to the known inventory.

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-65

State Virginia

Location	Front Royal	Front Royal	Front Royal	Front Royal	Front Royal
Breed of sire	Hereford	Hereford	Hereford	Hereford	Hereford
Breed of dam	Hereford	Hereford	Hereford	Hereford	Hereford
Line or group	H4	H5	H6	H7	H8
Percent used in project	100	100	100	100	100
Inventory as of July 1, 1965	Cows 2 years and over	16	16	29	27
	Yearling heifers	5	1	3	10
	Bulls and steers under 1 year	9	10	9	11
	Heifers under 1 year <sup>a</sup>	3	4	12	7
	Bulls over 1 year <sup>a</sup>	3	1	2	2
	Steers over 1 year				
	Percent pregnant <sup>1</sup>	92	80	73	90
Repro. perf.	Calf survival percent <sup>2</sup>	83	100	94	100
	Adj. ADG <sup>3</sup>	1.78	1.77	1.62	1.82
Wean. perf.	Av. type sc.	11.8	10.2	11.6	11.8
	No. of bulls	1	1	2	3
Postweaning performance	No. of heifers	5	1	3	10
	No. of steers	3	2	6	2
	No. of bulls	-	-	-	-
Slaughtered performance	No. of heifers	-	-	-	-
	No. of steers	3	2	6	2
					6

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments: age of dam, season of birth, sex, creep vs. no creep.

a. Additional calves expected between 5/1/65 and 7/1/65 have been estimated and added to the known inventory.

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Virginia

Location	Front Royal	Front Royal	Front Royal	Front Royal
Breed of sire	Hereford	Shorthorn	Shorthorn	Shorthorn
Breed of dam	Hereford	Shorthorn	Shorthorn	Shorthorn
Line or group	H9(Outside Breeders)	S1	S2	S4
Percent used in project	100	100	100	100
Inventory as of July 1, 1965	Cows 2 years and over	18	18	17
	Yearling heifers	6	1	5
	Bulls and steers under 1 year	7	4	8
	Heifers under 1 year <sup>a</sup>	5	7	3
	Bulls over 1 year <sup>a</sup>	2	2	2
	Steers over 1 year			
Repro. perf.	Percent pregnant <sup>1</sup>	72	17	57
	Calf survival percent <sup>2</sup>	100	67	100
Wean. perf.	Adj. ADG <sup>3</sup>	1.92	1.81	1.63
	Av. type sc.	10.6	10.6	11.2
Postweaning performance	No. of bulls	5	2	1
	No. of heifers		1	5
	No. of steers	5	-	3
Slaughtered	No. of bulls			
	No. of heifers			
	No. of steers	5		3

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments: age of dam, season of birth, sex, creep vs. no creep.

a. Additional calves expected between 5/1/65 and 7/1/65 have been estimated and added to the known inventory.

FORM I  
PRODUCTION, INVENTORY, AND PERFORMANCE DATA, S-10 HERDS - 1964-1965

State Virginia

Location	Front Royal	Front Royal	Front Royal	Front Royal	Front Royal
Breed of Sire	Shorthorn	Shorthorn	Shorthorn	Shorthorn	Various
Breed of dam	Shorthorn	Shorthorn	Shorthorn	Shorthorn	Various
Line or group	S5	S7	S8	S9 (Outside Breeders)	Crossbred
Percent used in project	100	100	100	100	100
Inventory as of July 1, 1965	Cows 2 years and over	21	35	31	
	Yearling heifers	3	8	10	
	Bulls and steers under 1 year	5	13	13	2
	Heifers under 1 year <sup>a</sup>	3	5	11	2
	Bulls over 1 year <sup>a</sup>	2	3	2	5
	Steers over 1 year				
	Percent pregnant <sup>1</sup>	89	71	90	100
Repro. perf.	Calf survival percent <sup>2</sup>	82	84	96	50
	Adj. ADG <sup>3</sup>	1.68	1.74	1.86	1.79
	Av. type sc.	12.6	12.9	11.1	11.4
Postweaning performance	No. of bulls	2	2	3	3
	No. of heifers	4	8	11	
	No. of steers	3	6	6	
Slaughtered	No. of bulls				
	No. of heifers				
	No. of steers	3	6	6	

1. Use palpation percent or percent of cows that gave birth to calves (dead and alive). Include in total cows all those which were in the breeding herd and for which pregnancy status was determined. (Wean. % = % pregnant x survival %)
2. Percent of calves born (dead and alive) that survived to weaning.
3. Indicate adjustments: age of dam, season of birth, sex, creep vs. no creep.
  - a. Additional calves expected between 5/1/65 and 7/1/65 have been estimated and added to the known inventory.
  - b. 2 - Front Royal and 2 - outside breeders



